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JOURNAL

OF THE

American Veterinary Medical Association

FORMERLY AMERICAN VETERINARY REVIEW

(Original Official Organ U. S. Vet. Med. Ass'n.)

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YOU SHOULD GO

ST. LOUIS will be the center of attraction for the American veterinary profession from August 28 to September 1, when the American Veterinary Medical Association holds its fifty-ninth annual meeting there.

The convention itself, with its fine program and good fellowship, is a sufficient attraction to warrant large numbers in making the trip. The papers and addresses will present much that is of great interest and benefit to all elements of the profession—general practitioners, specialists, educators, scientists and sanitarians. The clinics will be of special interest to practitioners. The cultivation of a professional spirit and the advancement of professional interests merit the consideration of all our members. The renewal of old and the formation of new friendships are a pleasing incidental feature of these annual gatherings. The entertainment features promise to be unusually enjoyable. The "regulars" who go from year to year will need no urging, and the veterinarian who has not had the privilege of attending previous meetings will find it well worth his while to go to this one.

Some very practical problems may come up for solution—questions of organization, commercial practices as they affect

the profession, etc. Our best thought should be given to solving these wisely, having in mind only the best and highest interests of the profession as a whole.

The city chosen offers many advantages. It is geographically central, so that the largest number should be able to go at the least expense. Twenty railroads contribute to its accessibility, and the splendid roads entering the city through neighboring States will undoubtedly tempt a number of pilgrims to motor to the meeting. The city abounds in features of interest to the visitor, some of which are enumerated elsewhere in this issue. St. Louis is known as the "friendly city," where visitors are guests and there are no strangers.

So you might as well arrange your business and personal affairs, make your hotel reservation and transportation arrangements, and GO!

THE SWINE INDUSTRY TODAY AND ITS STATUS AS TO HOG CHOLERA

ONE OF THE SERIOUS offenses in Colonial days was the theft of a hog. Penalty befitting the crime was meted out as rigorously as for gaming on the Lord's Day, using profane language, or kissing one's wife in public. This point serves to illustrate that from the earliest day of swine raising in America this class of animals has been recognized as a valuable asset in the feeding of the family and the ever-increasing population, and that any factor responsible for retarding the progress of the establishing of swine herds deserved immediate suppression.

From a small beginning as a family larder provider, the pork tribe has increased to proportions which are little short of marvelous. From a little plot in the back yard as their home these mortgage lifters have multiplied and progressed until fertile plains and shady pastures constitute their domain in practically all States in the Union, and the industry has become an important economic factor. The tiller of the soil who does not include in his scheme of agricultural production a remunerative herd of hogs is rare indeed. Such a farmer lacks foresight.

Though the development of the swine industry has had many setbacks, the quality and quantity of these domestic animals have increased and improved steadily from year to year. The value of hogs has climbed accordingly and the prices now paid for

both dams and sires of purebred stock are good indicators of what stock owners consider as desirable investments.

In the last few years there has been somewhat of a variation in the growth of the industry, due partly to the inflated values obtaining during the war and the inevitable reduction to normal figures following the cessation of hostilities. The peak of production was reached during 1918, the number of hogs on American farms January 1, 1919, being given as 75,587,000. On that date the average value of each animal was stated to be $22.04, giving the country an item of national wealth amounting to $1,665,987,000. From this there is noted a reduction to 72,909,000 hogs on January 1, 1920, with the value reduced to $19.01 per head, decreasing the swine wealth to $1,186,212,000. Perhaps the greatest decrease in the number of hogs raised in one year occurred during 1920, as the estimates give but 66,649,000 on farms January 1, 1921. With this decreased production and a lowering in price to $12.99 per head, we note the total value shrinking to $865,633,000—a little short of the billion-dollar mark. There may not be, for a great many years, the same enormous profits that were reaped during the war, but with the stabilizing of values under normal times, farmers will find that the swine herd is as profitable an investment as any other item of farm production.

As indicated, the building up, fostering and maintaining of such a vast industry have not been accomplished without many difficulties. It is a matter of record that in its early history, and in fact at various periods during its development, the industry has suffered severe drawbacks and losses from the effects of infectious and contagious diseases. For a number of years the breeding and raising of swine involved such uncertainties of success, owing to the ravages of hog cholera, that efforts for the increase of herds and numbers were discouraged and in some cases abandoned. In three successive waves of that disease occurring in 1887, 1897 and 1913-14, such severe losses were sustained that in some localities the industry was for a time practically destroyed.

FEDERAL ASSISTANCE

The United States Bureau of Animal Industry became interested in the problem of reducing losses from hog cholera many years ago. As early as 1904 it announced the discovery of a

serum which would protect hogs against cholera. After further experiments for the perfecting of this biological product, representatives of the various States were made acquainted with the methods of producing the serum. Armed with this new weapon the battle against hog cholera took definite shape, and in 1913, Congress having appropriated funds for that purpose, a series of experiments were inaugurated in the field to demonstrate the practical value of serum and determine the possibility of checking the disease. Following these experiments, their object having been accomplished, work was established in a systematic and intensive way, the methods of procedure being modified to conform with the cooperation offered by the authorities of the various States. In general, the plan is to assist the livestock regulatory authorities, such as State veterinarians, livestock boards and departments of agriculture in the investigation, suppression and control of hog cholera. Comparing the number of hogs destroyed by cholera in 1913 with that of 1919 and 1920, we find a reduction in losses of over sixty per cent. In previous years mortality rates have been as high as 144 per 1000. Under systematic efforts in fighting the disease the rate has been reduced to as low as 38 per 1000.

The swine industry of the present day has become so great and of such value that its care and protection form an important part of the activities of veterinary practitioners. In years gone by the treatment of hogs for diseases was considered a ridiculous idea. Today, however, the immense wealth represented in the industry and the nation-wide agitation for improvement of types make it of the utmost importance for the hog growers, State and Federal authorities, and the veterinarians in field practice to take all precautionary measures to safeguard the swine herds in every way.

DANGER OF MISTAKEN DIAGNOSIS

The tendency of laymen to engage in the diagnosis and treatment of diseases of livestock has, in a great many instances, resulted in losses of animals through the inability of such laymen to diagnose properly or their applying remedies not indicated in specific cases. This practice is particularly dangerous in the handling of infectious and contagious diseases where not only the original herd is at stake, but through the spread of

infection other animals may become exposed, infected and, perhaps, destroyed.

In the work of controlling hog cholera, for instance, perhaps the greatest hindrance has been the tendency of farmers to attempt the diagnosis and treatment of diseases in their own herds, or else call in an untrained layman who does not recognize the trouble or advises the wrong procedure in the handling of the outbreak. It is not always an easy matter to make a positive diagnosis of hog cholera, as symptoms are sometimes obscure, and due to the fact that other ailments of swine, such as pneumonia, digestive disorders, tuberculosis, etc., at certain stages of development somewhat resemble hog cholera, training and experience are required to differentiate between these and cholera. Since the result of treatment depends on proper diagnosis, it is important that swine growers should realize the value of professional services and advice in handling outbreaks of disease in swine herds.

Practicing veterinarians should acquire all possible knowledge pertaining to the control and suppression of hog cholera. Complications associated with cholera have created a multiplicity of opinions among those who claim to understand the various ailments of swine, and even within the veterinary profession hasty judgment has, in many cases, occasioned losses which could have been avoided through a careful consideration of facts, proper diagnosis and treatment. This should emphasize the necessity for the study of cases, getting the history, noting the environments, and all other circumstances involved in an outbreak before attempting to announce the diagnosis. Even after a thorough physical examination, observing closely for abnormal actions in breathing, gait, appetite, digestion and other functions, it is not always possible to make a positive diagnosis until a post-mortem examination has been made.

It is evident that all swine-producing localities should have someone available whose services, from training and experience, are reliable in detecting and prescribing for diseases of livestock. Farmers should realize generally that they can not afford to jeopardize the safety of their herds by attempting to administer treatment which requires a fixed amount of technical application of which they have no knowledge. It is far better to pay a fair fee to a qualified veterinarian than to run the risk of losing

valuable animals, to say nothing of the possibility of causing a widespread epizootic outbreak of a destructive animal disease.

Cooperation of Veterinary Practitioners

Perhaps no one identified with rural community interests is so well fitted to judge of the needs for the betterment of livestock as the veterinary practitioner. Through his daily contact with conditions on the farm, noting the number of grades of animals in his community, he is in a position to have an excellent conception of the necessity for increased production, the selection of better types, and the proper care of herds. He realizes better than anyone else how costly and what a fallacy it is to allow each succeeding year enormous losses from diseases than can be prevented, if the proper advice is given, proper precaution taken, and proper care and treatment exercised. It is becoming more and more evident that veterinarians must look to the countryside for remunerative practice, and these professional men recognize that the more valuable the herd the better the chances for professional services. It follows that if infectious and contagious diseases are allowed to become rampant and destroy livestock, or discourage increased activities by farmers and breeders in building up greater herds and flocks, the services of veterinarians will not be in demand and their revenue will be decreased accordingly. T. P. W.

The responsibilities and perils of editorship are well illustrated by a recent experience of *The Veterinary Record,* the official journal of the National Veterinary Medical Association of Great Britain and Ireland. This journal published a letter from an anonymous correspondent casting serious imputations upon the professional honor of Sir John McFadyean. *The Record* now publishes a statement repudiating the statements in the letter as "devoid of any foundation and entirely unjustified" and explaining that "the letter in question would never have appeared had the Editor seen it, but unfortunately he was away on his holiday at the time, and the letter was carelessly inserted by a subordinate." *The Record* has agreed to pay a sum by way of damages, which it is understood Sir John will donate to the Victoria Veterinary Benevolent Fund, and has also paid to Sir John's solicitors the costs to which he has been put.

A CONTRIBUTION TO THE BACTERIOLOGY AND PATHOLOGY OF STERILITY IN COWS, WITH REPORT OF NINETEEN CASES [1]

By DONALD C. BEAVER

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INFECTIONS of the genital tract of cows have been attracting the interest of scientific investigators for many years. Stimulated by the discovery of the etiologic agent of bovine infectious abortion by Bang, workers have entered the field of comparative pathology in an effort to solve the problems of bovine sterility, which have become of great importance coincident with the increased prevalence of infectious abortion in cows. Contributions to the literature in this field have been for the most part clinical, although some notable work has been accomplished in bacteriology and pathology. Success of such investigations of great economic importance can be achieved only by concerted effort directed toward etiology. Although this paper deals only with the bacteriological and structural pathological considerations of the subject, there should be included at some future time more thorough investigations into the functional and chemical pathology. It is suggested that many of the problems of sterility lie beyond the vision of the microscope and that valuable additions to the literature on the subject might be obtained by careful study of sterility by workers in these branches of science.

In a general way, sterility may be said to result from either of two causes, first, congenital, and second, acquired. The congenital cause of sterility has as its underlying etiology the absence or arrested development of certain organs of reproduction. Acquired causes fall into two groups, inflammatory and noninflammatory.

In the inflammatory group we must consider specific infections, such as are produced by *Bacillus abortus, B. tuberculosis* and *Actinomyces bovis.* There also exist the more important nonspecific inflammations, as those caused by the invasion of

[1] Published with the approval of the Director as paper No. 381 of the Journal Series of the University of Minnesota, Agricultural Experiment Station.

parts of the female genitalia by *B. pyogenes*, streptococci and staphylococci. The female genital tract is composed of several structures, from vagina to ovary, the invasion of any one of which by pathogenic microörganisms may produce disastrous results. We must constantly guard ourselves in interpreting structural changes, as we see them, for it must always be borne in mind that although no related bacteriologic findings coexist, the changes in structure are in most cases associated with present or past infection. As a result of inflammation in one part of the genital tract, pathologic changes occur in another, while at the seat of the infection no visible changes in structure may be noted.

This is most clearly exemplified in the close relationship which exists between uterus and ovary, infections in one of which may produce structural changes in the other without apparently sufficiently disturbing the structure at the seat of infection to render the animal sterile. Infections as a rule lead to deviations from normal function, coincident with changes in structure. In some instances the changed structure, by purely mechanical means, may be sufficient to account for sterility. In other instances it is the resulting functional and biochemic change which is responsible for the loss of reproductive capacity. There still exists the possibility of pathologic disturbance, resulting from infection, being expressed only by changes in function, where the structural changes are not sufficient to be determined microscopically. In this last group may be placed many cases of sterility, the etiology of which can not be accounted for by either bacteriologic or pathologic study. In the light of our present knowledge a discussion of the latter is certainly theoretical and aims to cover ignorance rather than increase our knowledge.

In the noninflammatory group there may be included acquired displacements or injuries not resulting from infections, neoplasia, cysts and disturbed endocrine function. The environment of the animal may be an influencing factor in endocrine stability, and as such may be a contributing cause of sterility. These may include housing, feeding and breeding. The general condition of the animal with respect to undernourishment and excessive adiposity in all probability tends to suppress endocrine equilibrium, with consequent irregularities in the breeding disposition of the animal.

A discussion of some of the more important disturbances of the female genitalia with respect to etiology and pathology will be included. It is difficult to speak of disturbances in one part of the genital tract without relating them to consequent changes in other portions. It will be necessary, however, to adhere to a systematic consideration for brevity and lucidity. Such conditions as active and passive hyperemias, anemias and neoplasia are withheld from this report, except to mention them briefly in some instances.

DISTURBANCES OF THE OVARIES

I. Cystic changes are among the most frequently encountered pathologic disturbances of the ovaries. Ovarian cysts may be classified in the following manner:

1. Simple ovarian cysts (retention cysts).
   (a) Originating from the Graafian follicle.
   (b) Originating from the corpus luteum.
   (c) Originating from remnants of the Wolffian duct.
2. Neoplastic cysts.
   (a) Serous and pseudomucinous cystadenomata (benign).
   (b) Cystadenomata with carcinomatous change (malignant).

Retention cysts constitute the type most frequently encountered in the bovine. The Graafian follicle cyst results from failure of rupture of the follicle with consequent retention and accumulation of liquor folliculi. These cysts consist of essential elements of the Graafian follicle, with a degenerated ovum, an atrophic and flattened-out stratum granulosum and a usually increased density of the liquor folliculi. Other types may be due to disturbed or arrested development of the follicle, when, as a result cystic degeneration of so-called atretic follicles, cysts may result. The cyst resulting from the corpus luteum is seen when, in place of normal involution of the luteal structures, a cystic degeneration supervenes. Cysts of this character will be seen lined at first by flattened-out luteal cells, and later by hyalinized connective tissue and luteal detritus. The contained fluid is usually clear but may be sero-sanguineous in character. Remnants of the Wolffian duct are rarely seen as cysts in the ovary, but occasionally are encountered in the parovarian structures. Some workers have emphasized size as an indicator of

cystic ovaries. It should be borne in mind that cysts may be single, in which case they are eventually large, or they may be multiple, in which case they are usually small. Size alone is no criterion by which cysts may be defined.

Neoplastic cysts of the bovine ovary seem to be of relatively infrequent occurrence. They are supposed to result from continued tubular downgrowths into the ovarian substance, of Pflüger's egg cords, or from the germinal mesothelial structures surrounding the ovary. In any case the cyst is lined by simple or stratified epithelial-like cells. The arrangement of the epithelium may be simple or papillary, and the cyst may be single or multilocular. They are to be distinguished from retention cysts in that the cells are of an actively proliferating type, marked growth impulse being always seen. The epithelial lining secretes either a serous fluid or one in which pseudomucin predominates. Malignant cysts are essentially the same, with difference in growth restrictions.

The etiology of retention cysts is believed by many workers to be inflammatory. Rosenau and Davis (1)[1] have associated *Streptococcus viridans* with cystic ovaries in women. Fitch (2) in studies upon cystic bovine ovaries found streptococci and *Bacillus coli*. Ewing (3) states that the "fairly constant occurrence of inflammation of the pelvic organs points to the inflammatory origin of these cysts." Other workers, notably Loeb (4), have been able to produce ovarian cysts by underfeeding guinea-pigs. Only by excessively underfeeding was he able to produce the condition, but then with considerable regularity.

In our studies it has not been possible to isolate, with any degree of regularity, bacteria from retention cysts of the ovaries. It seems possible, in view of this, that cystic ovaries may be produced through reflex influence upon ovarian function which may take place from uterine infections.

II. Pathological retention of the corpus luteum is frequently seen. In some cases the yellow body undergoes continued evolution and atrophy. The luteal structures develop a fair degree of vascularity and become firmly encapsulated by connective tissue. As a result of this continued retention there is derangement of the diœstrous cycle.

[1] Numerals in parentheses following authors' names refer to list of literature at end of paper.

III. Inflammations of the ovary (oöphoritis) are acute and chronic. The acute types are most often associated with abscess formation from extension of peritonitis, perimetritis or salpingitis. Such infections when associated with salpingitis frequently result in the formation of tubo-ovarian abscesses. The abscess usually occurs at the site of a ruptured Graafian follicle. As the abscess develops the tube and ovary are brought into close apposition, so as to appear irregularily as one. It may develop to an enormous size, entirely obliterating the structures in which it occurs. Such abscesses result from invasion by *Bacillus pyogenes,* streptococci and staphylococci. Chronic oöphoritis is seen as an inflammation of lower grade, in which there are proliferative changes with lymphocytic or plasma cell infiltration, rather than exudative suppurative developments. The result of this type of inflammation is to leave a fibrotic ovary.

Specific infections of the ovary, such as tuberculosis or actinomycosis, are rarely observed.

IV. Neoplasia of the ovary in the bovine are rare and will not be considered in this report.

V. Sterility of the ovary in the bovine, as well as in other animals, is noted in the aged. As a result of long-continued rupture of Graafian follicles and production of corpora albicantia the ovary gradually becomes smaller and hardened. Such ovaries are usually functionless and are spoken of as sterile or senile ovaries.

DISTURBANCE OF THE UTERINE TUBES

The importance of diseases of the uterine tubes in relation to sterility can not be overestimated. It must be kept in mind that the uterine tubes or the oviducts are the connecting links between the ovaries and the uterus, and that the ova must pass through them in order to reach the uterus. It will be remembered that their lumen is narrow, their structure delicate and their mucosa thrown into plicæ directed toward the center, so that injuries, although slight, may result in temporary or permanent sterility. In this report only inflammatory conditions of the tubes will be considered.

Salpingitis may be acute, subacute or chronic, and affect any of the coats, and as such is designated as endosalpingitis or perisalpingitis. It is rather rare that the mucosa alone is at-

tacked. It is more usual to see all coats involved in the inflammatory process. The following classification will be found to include most inflammatory conditions of the tubes:

1. Catarrhal salpingitis (acute or chronic).
2. Suppurative salpingitis (acute or chronic).
   (a) Pyosalpinx.
   (b) Hydrosalpinx.

In general it may be said that salpingitis results only from bacterial infection. The most frequent organisms seen in association with these conditions are streptococci, *Bacillus pyogenes* and staphylococci. It is doubtful whether *B. abortus* or *B. coli* are responsible for pathologic changes in the uterine tube. Salpingitis as a rule is secondary to puerperal infection, but the possibility of its being primary must be also considered. Salpingitis is often bilateral, but is not infrequently seen affecting one tube, especially in the chronic stages.

1. Catarrhal salpingitis is acute in the early stages of mucosal inflammation. The chronic type, rarely seen, is the product of low-grade infection. Gillman (5) has recently placed emphasis upon this type of salpingitis. Our work has not been of sufficient extent to confirm his observation. In catarrhal salpingitis the mucosa is seen in a state of active mucus secretion. The walls of the tubes are edemic and infiltrated rather mildly with mononuclear types of cells. If the inflammation continues for a length of time the walls will thicken and become fibrotic and fusion may occur amongst the plicæ.

2. Suppurative salpingitis is usually acute in character. The tube is diffusely infiltrated with polymorphonuclear leucocytes, and much purulent exudate distends the lumen. The plicæ flatten out and are subjected to mild pressure atrophy. The walls at first undergo pressure changes, but later, due to the inflammatory stimulus, fibrosis occurs. In this stage free drainage exists toward the cornua uteri for the purulent material.

The chronic stage is dependent upon the continued progress of the infection. The tube from increased fibrosis undergoes greater kinking and deformation. The epithelial folds undergo hypertrophy and become adherent to one another through fibroblastic proliferation. Plicæ from one side of the tube may become adherent to those of the other side. The abdominal osteum of the tube becomes closed, and later the portion of the tube near the isthmus. At times the plicæ in their fusion leave areas lined

by columnar epithelium deep beneath their surfaces. These areas give the appearance of isolated glands below the mucosal surface. The tube becomes distended and the walls thinned from pressure. The adherent plicæ become much thinned and stretched from pressure. This pus-distended tube is called pyosalpinx.

The bacteria gradually die and their products undergo lysis. The tubal epithelium regenerates to some extent and secretes mucus. This secretion, together with products of lysis, forms a clear, straw-colored fluid, distending the tube. In this state we speak of the condition as hydrosalpinx. The pathologic changes in this condition are clearly set forth in the case reports. In the human pyosalpinx and hydrosalpinx almost invariably form a retort-shaped tube with the small end near the uterus and the abdominal end adherent to the ovary. Adhesions to the ovary are as a rule seen in the bovine, but the retort-shaped tube rarely results.

Of the specific infectious diseases, tuberculosis and actinomycosis are found in the uterine tubes, the former more frequently. The pathologic changes resulting closely simulate changes characterizing these diseases in other locations. In tuberculosis, pyosalpinx and hydrosalpinx may result, but with slightly different changes.

DISTURBANCES OF THE UTERUS

Only the inflammatory conditions affecting the uterus will be considered. All types of inflammations of the uterus may easily be included in:

1. Catarrhal metritis (acute or chronic).
2. Suppurative metritis (acute or chronic).
   (a) Pyometra.
   (b) Cystic degeneration of uterine glands, etc.

Subacute stages also exist, but these are late acute or early chronic stages.

The etiology of metritis may be any one of the organisms listed, or, as perhaps is more frequently the case, two or more types in association. The list includes *Bacillus abortus, B. pyogenes,* streptococci, staphylococci, *B. coli, B. tuberculosis* and *Actinomyces bovis.* It may be for the most part assumed that metritis develops only as the result of infection, although

many times trauma and irritating chemicals predispose to invasion by microörganisms.

Eggink (6) in an analysis of 20 cases of acute and chronic metritis found the following organisms: *Bacillus tuberculosis* 12 times, *B. pyogenes bovis* 14 times, streptococci 12 times, *B. coli* 6 times, staphylococci 5 times, *B. proteus* 3 times, *B. subtilis* once. In many of these cases mixed infections were present, so that from analysis of his report the most important types appear to be *B. pyogenes* and streptococci. Except in one case of tuberculous metritis, either one or both of these important types were always found.

Lucet (7) first described *B. pyogenes bovis* in 1893, when he studied 52 cases of suppuration in cattle. In these he found *B. pyogenes bovis* pure 10 times and associated with other organisms 7 times.

Grips (8) later studied suppurations in swine, when he isolated rather constantly *B. pyogenes suis.* He concluded his type to be identical with *B. pyogenes bovis* (Lucet) and proposed the name *B. pyogenes* for both, a point generally accepted.

Künnemann (9) studied many cases of suppuration in cattle and concluded that *B. pyogenes* was the most important etiologic agent. He observed this organism in 90 per cent of cases, in 33 per cent of which he isolated it in pure culture and in 55 per cent associated with other organisms.

In a complete report of 18 cases (purulent, acute and chronic metritis) Wall (10) obtained comparable results. *B. pyogenes* was found 6 times, streptococci 4 times, streptococci and *B. pyogenes* 5 times, streptococci and *B. coli* once, streptococci, *B. pyogenes* and *B. coli* once, streptococci and an anaerobic bacillus once.

Ward (11) appears to have been the first to demonstrate the presence of *B. pyogenes* in this country. Since then the organism has occasionally been reported. Brown and Orcutt (12) in their "Study of *B. pyogenes*" worked with twelve strains of the organism, five of which were isolated from cases of purulent metritis.

The results of the present investigation support the concurrence of views already cited. It seems from our studies that streptococci and *B. pyogenes* play the most pathogenic rôles in metritis and other inflammatory conditions of the genital tract of the cow.

1. Acute catarrhal metritis is very frequently seen. It is the type of inflammation occasioned by organisms of low-grade virulence for the uterine structures. Probably *Bacillus abortus* is most often the exciting organism. Following the infection of the placenta and uterine cotyledons by *B. abortus*, an inflammation is occasioned which results in the premature delivery of the fetus. This organism is not capable of establishing itself in the normal involuted uterus and soon disappears from that organ following the abortion. If no secondary infection follows, only a mild acute catarrhal endometritis will ensue, marked by excessive mucus discharge, which, as involution takes place, will disappear without permanent changes remaining. The mucous membrane exhibits a patchy necrosis, mucoid degeneration and exudative phenomena. The necrosis is a normal accompaniment of involution of the uterus, an expression of the physiologic discharge of the maternal placenta and remnants of the fetal membranes. No permanent damage to the organ results if no further infection takes place. Wall (10) states that shrinkage and atrophy of the gland mucosa may occur, with probably similar changes in the caruncule. A stimulus such as would be afforded by a mild type of infection might lead to hypertrophic endometritis, where the uterine mucosa is much thickened. Polypoid endometritis, doubtless inflammatory in its inception, may follow similar mild attacks or those of more severity.

Chronic catarrhal metritis, similar to acute, is usually seen involving only the endometrium. It is the expression of low-grade inflammatory reaction and is a rather rare occurrence. It may sometimes be seen as in the end stage of a more severe suppurative condition. Many times a condition of the endometrium simulating a chronic catarrhal endometritis is seen in which it is impossible to isolate organisms of any kind. It is suggested that cases such as these are not true metritis at all, but are an expression of altered ovarian function. A close study of the changes of the endometrium throughout the diœstrous cycle supports this view.

2. Acute suppurative metritis in a vast majority of cases results from puerperal infection. It may follow either an abortion or a full-term parturition, especially when force is applied to aid delivery. Retention of the placenta in either case is a vital contributing factor of utmost importance. It has already

been shown that the bacillus of infectious abortion causes in itself only a catarrhal endometritis of short duration. It will be easily seen that although *Bacillus abortus* does not cause grave danger itself, it affords a lowered resistance of the uterine structures, and that during such time other pathogenic organisms may enter and cause a more severe reaction. Lowered resistance from other causes constitutes the same potential danger. The sloughing of the carunculæ should be regarded as an avenue for invasion. At times a purulent metritis is set up, which soon heals, leaving only slight sequelæ or none at all. In infections of this character a mucopurulent exudate is found in the lumen of the uterus, and the endometrium exhibits the ordinary exudative phenomena of acute exudative inflammation. The reaction may also include the muscularis and serosa. Sequential to this type of infection, increased fibrosis of the endometrium may result, together with hypertrophy of uterine and glandular epithelium. The uterine epithelium may exhibit a replacement of simple columnar type of epithelium by a stratified ectodermal type as seen in the portio vaginalis uteri. This process as observed by Wall (10) is called "ectodermoisering." Unless this type of metritis passes on to the chronic stages, these changes are as a rule not seen.

A more severe type of infection is occasionally found. Its etiology is practically the same as for the less severe, but more often has associated with it *Bacillus pyogenes*. The inflammatory reaction is greater, much more purulent exudate is formed, and usually involves all layers of the uterus, the parauterine structures, uterine tubes and ovaries. Large pelvic abscesses usually form. It sometimes happens that the purulent exudate within the uterus is not able to escape. The uterus fails to undergo involution (coincident with retention of the corpus luteum), and a uterus containing several liters of pus is the result. Such a condition is known as pyometra. Eventually partial drainage will establish itself if the animal survives, but the infection will persist. It is this persistent, severe, purulent metritis which, as it passes on to the chronic type, leaves a uterus certainly severely damaged, and many times with salpingitis, oöphoritis or pelvic peritonitis as sequelæ. In cases of sterility resulting from infections as just described, speculation is unnecessary when the pathology of the uterus is investigated. Even in these cases, experience has shown, under

proper treatment, it is possible to have complete recovery of breeding function; in other cases where normal estrum has been reestablished the animal fails to conceive, or if conception does occur, abortion frequently follows.

Chronic suppurative metritis has already been mentioned. It will only be necessary to describe the pathologic changes seen. These are fibrosis of the endometrium, hypertrophy of the muscularis and "ectodermoisering" of the epithelium. The gland mucosa exhibits dilated and cystic glands, resulting from occlusion of their lumina through fibrotic stromal changes. The glandular epithelium is usually flattened out from pressure, and the lumen contains polymorphonuclear leukocytes and plasma cells. An area of dense, fibrous, often hyalinized connective tissue surrounds the dilated and cystic glands. In some areas there is actual atrophy of the glandular structures. The uterine blood vessels exhibit irregular intimal thickening, especially in the caruncule. The cystic changes in the glands may be of such an extent that grossly the cysts stand out as small areas from the size of a millet seed to a pea (or larger). Such conditions are described most often as cystic degeneration of the uterus, but usually no attempt is made to associate this change with past infection. In the final stages, in place of cystic glands being the most prominent picture, a catarrhal reaction may supervene. This, together with lysis of dammed-up purulent exudate, will produce a condition simulating hydrosalpinx. This condition is spoken of as hydrometra.

In summing up the subject of metritis as related to sterility, Hallman (13) has expressed a very tenable view:

> **The lesions observed in varying degrees in the different cases are mucoid degeneration of the superficial epithelium, local and diffuse fibrosis of the uterine mucosæ, leukocytic infiltration of the stroma and gland luminæ and degeneration and disintegration of the glandular epithelium with dimunition in the numbers of glands. In the majority of cases the anatomical alterations are comparatively few and it is hardly conceivable that failure to breed was the result of loss of functional tissue of the uterine mucosæ.**

In general, selecting cases of sterility as they come, our work bears out his opinion. The uterus seems especially capable of preserving itself for a long time without any marked structural damage resulting, so that it is more frequent to find, in sterile cows, a uterus in good condition so far as we can judge from structure.

DISTURBANCES OF THE CERVIX

The infections of the cervix can be classified in a similar manner to those of the uterus. The cervix is, however, more prone to become anatomically deranged. This is due to the deep cervical folds, which offer suitable abode for growth of microörganisms. It is thus seen that the cervix may be the reservoir of virus, and from this source infections of the genital tract have their origin. As a result of inflammation the cervical folds hypertrophy and the epithelium undergoes frequently mucoid degenerative changes. Such conditions interfere with the breeding of the animal, but in many instances are relieved by proper medication and surgical manipulation. The chief danger lies in extension of the infectious process either by continuity or by metastasis through the pelvic lymphatics to other parts of the genital tract.

Of the specific infections, tuberculosis and actinomycosis are uncommon. The condition produced is in all essentials like that seen in other parts of the body as a result of invasion by the specific organisms of these diseases.

THE PRESENT INVESTIGATION

Method of Study

The object during the progress of this investigation was to study cases which were diagnosed by clinical procedure as sterile. Sterility in some instances was considered as absolute, and cases falling into this group were slaughtered and the genital organs studied both pathologically and bacteriologically. Clinical history, although not always complete, is available in all cases of this group, as are also bacteriologic reports of uterine swabbings, where possible to obtain. Other animals were presented at the University clinic for treatment by one of us (Boyd), and in a majority of cases responded favorably to the therapeutic procedures employed. Since the animals were valuable purebred stock, slaughter was held inadvisable. In these cases bacteriologic study combined with clinical data constitute the report. Cultures were also obtained from the genital tract (uterus) during the progress of the infection. This was accomplished in all cases by inserting sterile swabs into the uterus through the retracted and dilated cervical canal. At necropsy the genital organs were carefully removed and cultures sys-

tematically prepared. The medium employed consisted of 10 per cent sterile horse serum agar in slants. The medium was inoculated and sealed off with sealing wax and allowed to incubate at 37.5° C. from 10 days to 2 weeks undisturbed. By this method types such as *Bacillus abortus* would develop. Aerobic pour plates were prepared, using agar in combination with 5 per cent sterile defibrinated horse blood. By this method streptococci and *B. pyogenes* were most easily obtained in pure culture.

Cultures were identified individually. In the work with *B. pyogenes* the investigations of Lucet (7), Künnemann (9), Grips (8), Glaze (14) and Brown (12) were consulted. For the work on streptococci the monograph of Brown (15) and the studies of Hollman (16) have constituted the basis for classification. The publication of Winslow and others (17) has been adhered to rather rigidly in the classification of the staphylococci. Although it was difficult always to have agreement of types to conform with the classification, it was thought that it represented the best system yet devised.

As soon as possible after culture material had been obtained sections were taken from various parts of the genitalia for pathologic study. These were fixed in Zenker's solution and in 10 per cent formalin. Sections were prepared by paraffin and freezing methods. For the most part hematoxylin and eosin were employed for staining.

Case Reports

In all 19 cases were studied. One (No. 19) does not have a clinical history.

Case 1

Clinical History.—Jersey cow, age 5 years. First calf born at 2½ years of age, full term but born dead. Second calf aborted. Previous to abortion, agglutination reaction for *Bacillus abortus* positive in dilution up to 1-200. Six months following abortion was bred. Pronounced pregnant six weeks later. Examination one month following revealed animal to be non-pregnant. It is assumed that she aborted between first and second examinations for pregnancy. The animal never gave extreme evidence of œstrus. Bred frequently for one year following the probable abortion. Examination always showed normal genitalia. During last year blood of animal positive to

B. abortus (agglutination reaction), up to 1-1,000. History reveals prevalence of sterility in the herd from which she came. Mother and sister of this animal always conceived with difficulty. The animal's condition was considered incurable and for this reason she was slaughtered.

Necropsy.—Gross Description.—The genitalia appear normal excepting for persistent corpus luteum buried deeply in the stroma of the left ovary. The corpus luteum is 2.5 cm. in diameter. The center of this corpus luteum presents a cystic cavity 1 cm. in diameter.

Microscopical.—The vagina and cervix uteri are normal. The uterus presents degenerative changes of its innermost glandularis, characterized by pyknosis of nuclei, catarrhal changes in cytoplasm, increased mucus production and desquamation of epithelium. The stroma of the endometrium is fibrotic, an excess of collagenous connective tissue appears. The tubæ uterinæ are normal. The ovaries present many primordial follicles. Other follicles are atretic. These show increased cellularity and hypertrophy of theca folliculi, hypertrophy and hyperplasia of membrana granulosa. Some cells have pyknotic nuclei and a cytoplasm showing hyaline granular degeneration. Corpora albicantia are numerous throughout the ovarian stroma.

Bacteriologic Findings.—Uterus, uterine tubes and ovaries sterile. Vagina showed three types of organisms, *Staphylococcus aureus, Bacillus coli, B. subtilis.*

Diagnosis and Discussion.—The etiology of sterility in this case is not clear. It is possible that the deep-seated corpus luteum, present in the left ovary, was a contributing factor. The ovarian change seems insufficient to produce such a condition, likewise the changes of the uterus are hardly in themselves sufficiently pronounced to inhibit implantation of the developing embryo. Combination of ovarian and uterine disturbances is the most probable cause of the animal's sterility, possibly influenced by *Bacillus abortus* at some past time.

Case 2

Clinical History.—The animal was a Shorthorn heifer without history of pregnancy. Two breeding services permitted within one month. Following the second, a severe suppurative metritis and cervicitis was noted. Physical examination some time later revealed a severe suppurative metritis, adhesions of

genitalia to rectum and colon, an enlarged right ovary, cystic left ovary, and an enlarged right tuba uterina. Animal slaughtered after thorough examination.

Necropsy.—Gross Description.—Massive adhesions exist about all parts of the genitalia. The uterus and cervix are pyogenically infected. The tubæ uterinæ are dilated to 6 mm. The walls are thickened and fibrous and their lumina contain considerable purulent exudate. The left ovary presents a large, persistent corpus luteum, with cystic degeneration of the central portion of the ovary. The cyst measures 4 by 5 cm. in diameter. The left ovary is 6-8 cm. in diameter and is for the most part replaced by a large, centrally located abscess cavity containing a thick purulent exudate.

Microscopical Description.—The uterus presents an epithelium tending to exfoliate, cystic uterine glands, with atrophic and degenerative changes in the epithelial structures. The stroma and some glands show abundant evidences of long-continued suppurative infection, as is revealed by increased connective tissue with dilation of some glands through constriction of their necks and atrophy of others. There is a fairly abundant infiltration with polymorphonuclear and mononuclear types of cells. The muscularis is atrophic. The uterine tubes present an active, acute, suppurative process of fairly long duration. The predominant picture is that of pus-cell infiltration of the mucosa and adjoining structures. The walls are thickened. The right ovary shows fibrous replacement of ovarian structures, with focal polymorphonuclear infiltration. This constitutes the abscess wall as observed grossly. One section shows a cystic follicle with marked degenerative changes of its epithelial structures.

Bacteriologic Findings.—Uterus and uterine tubes, *Staphylococcus epidermidis, Bacillus coli, B. pyogenes, Streptococcus mitis* (Alpha type). Right ovarian abscess, *Staphylococcus aureus, Streptococcus mitis.* Right ovarian cyst. Sterile.

Diagnosis and Discussion.—Purulent cervicitis, metritis and salpingitis. Acute oöphoritis, and large corpus luteum cyst of left ovary. The etiology is in doubt only as to the predisposing cause of the infection. All changes described are the result of infection, and are of such a character that even though the active process might subside, the generative organs would be permanently damaged.

Case 3

Clinical History.—Heifer, 2 years of age. Delivered a dead full-term calf following severe dystocia at this age. Injury resulted which within five days was followed by severe, acute, purulent metritis. Parauterine abscesses soon developed. The abscesses were evacuated twice without improvement. Cultures obtained from the exudate showed *Bacillus pyogenes* and *Streptococcus anginosus* (Beta type). The animal became emaciated and developed a septic fever with loss of appetite. Slaughter was advised.

Necropsy.—Gross Description.—Extensive adhesions and deformity of the genitalia exist, resulting from large parauterine abscesses. The largest abscess is 14 by 10 cm. in size. The uterus presents hypertrophic caruncule and an acutely congested mucosa. But little exudate is present in the lumen. The right uterine tube is normal, the left is completely obliterated by the large parauterine abscess. The right ovary shows a large corpus luteum and cyst measuring 17 mm. in diameter. The left ovary, like the left tube, is lost to view in the large parauterine abscess.

Microscopical Description.—The uterine glands show hyaline granular degeneration of epithelium, in some cases, with increased lymphocytic infiltration of the endometrical stroma. The right uterine tube is mildly catarrhal. The right ovary presents many cystic Graafian follicles measuring 2-3 mm. in diameter. The nuclei of cells in the membrana granulosa are markedly pyknotic, and the liquor folliculi is of increased density, being uniformly dense and homogenous and of deep eosin staining. One section shows a small corpus luteum cyst still persisting.

Bacteriologic Findings.—Body of uterus, sterile. Right horn, *Bacillus pyogenes.* Left horn sterile. Right tube and ovary sterile. Large abscess, *B. pyogenes* and *Streptococcus anginosus* (Beta type).

Diagnosis and Discussion.—Mild metritis; catarrhal salpingitis, right tube; cystic Graafian follicles and small corpus luteum cyst in right ovary; extensive periuterine and parauterine abscess formation. The etiology is clearly set forth. The changes observed in the Graafian follicles may be the reflex result of pelvic inflammation and disturbed uterine function.

Case 4

Clinical History.—Heifer delivered premature fetus at 2 years of age. Typical abortion exudate existed. Six weeks following the delivery examination revealed a left ovarian abscess the size of an orange. Abscess increased in size until hope of recovery was abandoned. Cultures obtained from the abscess by vaginal puncture showed the following organisms: *Bacillus pyogenes, Streptococcus fecalis* (Alpha type), *Staphylococcus candidus.*

Necropsy.—Gross Description.—In the left pelvic cavity an abscess 28 by 23 cm. has formed. Several smaller ones are also visible, the larger of these being 12-15 cm. and 6-8 cm. in size. The abscess contains purulent exudate with an extremely offensive odor, and massive pelvic adhesions exist. The uterine carunculæ are hypertrophic and hyperemic. The left uterine horn is deformed. The right uterine tube is normal, as is also the right ovary. The left tube and ovary are lost to view in the large abscess mass.

Microscopical Description.—The uterus shows only slight structural departure from the normal; there is edema of the walls, with tendency to epithelial desquamation. Increased cellular infiltration is also exhibited. The right tube is normal. The right ovary presents cystic follicles as described in Case 3. In some ova are seen a state of hyaline degeneration. Small cystic remains of corpora lutea and corpora albicantia are also seen.

Bacteriological Findings.—Uterus, right tuba uterina and right ovary are sterile. Parauterine abscesses, *Bacillus pyogenes, Streptococcus fecalis* (Alpha type), *B. proteus* and *Staphylococcus candidus.*

Diagnosis and Discussion.—Mild metritis, cystic degeneration of Graafian follicles of right ovary, periuterine and parauterine abscesses. The relative immunity of most of the genital tract from the infective process seems remarkable. The changes described for follicles of the right ovary are comparable to those reported in Case 3.

Case 5

Clinical History.—Aged Holstein cow. Aborted last fetus, following which severe purulent metritis developed. Recovery had apparently been made in three months. Had failed to con-

ceive in six months. Physical examination revealed a condition rendering the animal of no further breeding value.

Necropsy.—Gross Description.—The only gross pathology exhibited is in the right uterine tube and ovary. The tube is dilated to 1 cm. at the distal end, where it is also very tortuous. The lumen contains a clear, straw-colored fluid, which is inclosed in apparent multilocular cavities. At the fimbriated end of the tube the ovary is adherent through the development there of a tubo-ovarian abscess. The abscess contains a thick, purulent exudate and is surrounded by a dense wall which has for the most part replaced the normal ovarian structure. The left ovary contains a large corpus luteum.

Microscopical Description.—The sections of the uterus and left uterine tube appear normal. The right tube presents a normally appearing isthmus. Sections across the ampulla show walls of increased thickness, fibrous thickening of mucosal plicæ, and mild lymphocytic and polymorphonuclear infiltration. The plicæ are adherent to one another and have, it appears, been in places closed off so as to appear as multilocular cystic cavities. The epithelium is atrophic, from intrinsic pressure. The right ovary is sclerotic, and is diffusely infected. Some cystic Graafian follicles appear. The left ovary presents cystic degenerative changes in its medium-sized follicles, characterized by degeneration and atrophy of membrana granulosa, increased albuminous content of liquor so as to give it a uniform, deep eosin staining, glassy appearance. Some small corpora luteal remnants are persisting and cystic.

Bacteriological Findings.—Body of uterus and left horn are sterile, also the left tube and left ovary. The right uterine horn, *Bacillus pyogenes.* Right uterine tube, *B. pyogenes, Streptococcus ignavus* (Alpha type), *Staphylococcus candidus.* Tubo-ovarian abscess, *B. pyogenes, Streptococcus ignavus.*

Diagnosis and Discussion.—Right hydrosalpinx, right tubo-ovarian abscess, with sclerotic and cystic changes in right ovary. Cystic degeneration of Graafian follicles in left ovary. The existence of sterility in this case, where the active inflammatory process involved but one side, exemplifies the relation of ovarian function to uterine, and also of one ovary to the other.

Case 6

Clinical History.—Holstein cow, age 12 years. Last calf normal, December, 1919. The animal was bred at irregular inter-

vals, January, April and July, 1920. No history of disease. Examination in October, 1920, showed a bilateral hydrosalpinx, with large cystic ovaries. Sterility was considered as incurable, and slaughter was advised.

Necropsy.—Gross Description.—The internal os uteri presents cystic areas deep beneath the epithelial surface. A new growth, 2 cm. in diameter, located in the muscularis of the corpus uteri appears. The tumor is partially subserous. Growth is soft and well circumscribed. The uterus otherwise is normal. The right uterine tube is normal at the isthmus. Gradual enlargement occurs until a diameter of 1.5 cm. is obtained. The walls are thin and the tube runs a markedly tortuous course. The lumen contains clear serous fluid. The left tube is similarly altered. The right ovary presents a centrally located cystic corpus luteum. The left ovary appears normal.

Microscopical Description.—Cystic glands in the internal os uteri are characterized by low, flattened cuboidal epithelium with very irregular outlines. The contents of the cysts are densely homogenous and eosin staining. Sections of the tumor reveal a fasciculated structure of smooth muscle cells. The uterus is otherwise normal. The uterine tubes present fibrotic but thin walls of connective tissue. The epithelium of the mucosa is greatly flattened. The plicæ are stretched and converge toward the center of the lumen where connective tissue is much more abundant, giving the centrally converging folds great thickness. The adherent folds give the tube an appearance of multilocular cysts. A mild lymphocytic infiltration exists throughout. The ovaries are sclerotic and show cystic Graafian follicles as described in Case 5.

Bacteriological Findings.—Os uteri externum and corpus uteri, *Staphylococcus aureus, Staph. aurantiacus, Bacillus coli,* Cornua uteri, tubæ uterinæ and ovaries sterile.

Diagnosis and discussion.—Cystic glands in internal os uteri, leiomyoma of uterine body, bilateral hydrosalpinx, sclerotic ovaries with cystic Graafian follicles. In this case history of infection is lacking. In all probability a puerperal infection followed the last parturition, from which sufficient deformity occurred to produce the bilateral hydrosalpinx.

Case 7

Clinical History.—An aged Holstein cow. Last pregnancy, 13 months ago, was followed by retention of the placenta.

Physical examination disclosed a chronic cervicitis, hypertrophy of the external os uteri, associated with a deep-seated corpus luteum in the right ovary. Cultures prepared from the cervix gave the following growths: *Bacillus pyogenes, B. coli, Staphylococcus aureus, Staph. aurantiacus.* After three months of treatment, the animal's condition being regarded as incurable, slaughter was advised.

Necropsy.—Gross Description.—A large quantity of mucopurulent exudate exists in the vagina, the mucosa of which is inflamed. The Bartholin ducts are cystic, measure 2 cm. in diameter and contain a thick pseudomucinous material. The folds of the external os uteri are hypertrophic and the mucosa is studded with granular, vesicular areas, pin point in size. The cervical canal contains much thick, yellow, purulent exudate. The corpus uteri shows no change. The right cornu is indurated and is one-third smaller in size than the left. At the bifurcation of the uterus, on the serosa, above and to the right, an adhesive mass of tissue exists. At this portion the wall is hard and thick. The right cornu is flaccid and contains considerable pus; the left contains less. The right tuba uterina is distended to 1 cm. in diameter with clear serous fluid. The abdominal stroma is obliterated by a mass of dense fibrous tissue, 10 by 4 by 7 cm. in size. Mesentric fat adheres to it so that a loop of the small intestine is brought into close apposition. This connective tissue mass is so constituted as to replace the normal ovarian structure, and in its center purulent exudate is shown. The left tuba uterina presents slightly thickened walls and is dilated. The left ovary is normal.

Microscopical Description.—The vaginal mucosa exhibits only mild desquamation of superficial cells. Sections of the cystic Bartholin ducts show only mild inflammatory exudate, with a cystic material staining faintly neutral, in which cholesterin clefts are plainly visible; tiny globules of neutral fat are also seen. The cervix shows proliferation of connective tissue and superficial epithelial cells. This proliferation has in many instances occluded the outlets of the cervical folds, so that gland-like structures lie buried beneath this tissue. The epithelial cells are catarrhal. The walls are diffusely infiltrated by plasma cells and large lymphocytes. The entire uterus shows marked structural changes. In one section the lining epithelium appears as stratified ectodermal, six to eight cells in thickness.

The change is abrupt, for at each end transition to simple columnar occurs at once. This change corresponds to that described by Wall (10) as "ectodermoisering." The surface epithelium shows mucoid degeneration, except in the ectodermoised area. Beneath the epithelial surface the endometrium is densely infiltrated with leucocytes. Plasma cells predominate, while polymorphonuclear leucocytes and lymphocytes are also numerous. The uterine glands show marked atrophic changes. In some places, due to the proliferative changes about the glands, the ducts have been occluded. This has resulted in great dilation of the glands, with retention of mucus. They are irregular and tortuous in outline. The epithelial lining is now cuboidal in type. The uterine stroma is fibrotic and there is noticeable diminution of numbers of glands per field . The myometrium is involved in the inflammatory process. Bilateral involvement of the uterine tubes exist. The serosa and muscularis are increased in thickness and are edematous. The plicæ are hypertrophic and hyperplastic. They converge toward the center, where they are adherent, and where a large mass of connective tissue has proliferated. Due to this adherent condition and overgrowth of connective tissue, many folds have been brought together at their base so as to appear as acini of glands. All plicæ, even where adherent, are lined by a simple columnar epithelium. Focal aggregations of leucocytes are seen throughout the tubal walls. Both ovaries show dense focal lymphocytic infiltration. Large follicles show only changes expressed by increased density of liquor folliculi. Small follicles exhibit degenerative changes of ova and membrana granulosa. These changes are not marked and are difficult of interpretation. The right ovary is fibrotic.

Bacteriological Findings.—Os uteri and uterus, *Bacillus pyogenes, Streptococcus nonhemolyticus* (Gamma type), *Staphylococcus aureus.* Uterine tubes, right tubo-ovarian abscess and ovary; *B. pyogenes, Strep. nonhemolyticus, Staph. epidermidis.* The left ovary is sterile.

Diagnosis and Discussion.—Mild vaginitis, cystic Bartholin ducts, chronic purulent cervicitis and metritis, bilateral hydrosalpinx, right tubo-ovarian abscess, sclerosis of right ovary, bilateral chronic ovaritis and cystic degeneration of Graafian follicles. Discussion of etiology of sterility in this case is unnecessary.

Case 8

Clinical History.—Holstein cow, age 4 years. During last 10 months animal has been bred 12 times without conception. Last calf delivered normally. No abortion in this animal, but the disease existed in the herd five years ago. Necropsy was obtained.

Necropsy.—Gross Description.—The animal is poorly nourished. The genitalia are normal excepting for cystic-appearing Graafian follicles and a retained corpus luteum imbedded deeply in the substance of the left ovary.

Microscopical Description.—The vagina and cervix are normal. Superficial uterine glands are active, appearing according to Marshall's (18) description to be in the state of proestral activity. The uterine tubes and ovaries are normal.

Bacteriological Findings.—Os uteri externum corpus uteri and right horn, *Staphylococcus aureus, Staph. aurantiacus, Staph. candidus.* Left uterine horn, uterine tubes and ovaries are sterile.

Diagnosis and Discussion.—Any hypothesis of the etiology of sterility in this case, in the light of present knowledge, can only be speculative. The deeply seated corpus luteum found in the left ovary possibly influenced conception. If this had been enucleated that might have cleared up the condition. The undernourishment of the animal may have influenced endocrine stability, so that by general suppression of this important secretion ovarian sensibility was reduced.

Case 9

Clinical History.—Aged Holstein cow. Several calves were born normally before the animal failed to conceive. The animal had been sterile one year when brought to our attention. Physical examination revealed only a mild cervicitis. Necropsy was obtained.

Necropsy.—Gross Description.—Folds of the external os uteri are hypertrophic. The cervical canal presents a thick, tenacious discharge of mucus. In the wall of the corpus uteri, a well circumscribed, spherical, submucous tumor exists. The uterus is otherwise normal. The right tuba uterina is normal. The left tube is normal excepting for adherence of the fimbriated extremity to the ovary. The tube is here dilated and contains a clear serous fluid. The right ovary contains many follicles,

appearing cystic. The left ovary contains a normally appearing corpus luteum. No pathologic change is discernible.

Microscopical Description.—The cervix appears normal. The uterus shows only occasional fibrotic areas. Sections of the new growth described for the corpus uteri exhibit a fasciculated structure composed of smooth muscle. The left tuba uterina is normal, excepting at its tip, where it adheres to the ovary. At this point the plicæ adhere to one another and are greatly stretched and thinned, representing an arrangement of small, multilocular, cystic cavities. Occasional collections of lymphocytes are seen in the tubal wall. The right tuba uterina is normal. The left ovary shows cystic degenerative changes of medium-sized Graafian follicles, also atretic degeneration of smaller ones. The right ovary shows similar changes. Both are sclerotic.

Bacteriological Findings.—Os uteri externum, *Staphylococcus epidermidis.* Right cornu uteri, *Streptococcus mitis* (Alpha type). Corpus uteri, left cornu uteri, uterine tubes and ovaries are sterile.

Diagnosis and Discussion.—Leiomyoma of corpus uteri, hydrosalpinx of right tuba uterina, with adhesions to ovary, and sclerotic changes in ovaries with cystic degenerative changes of follicles. Sterility in this case can be accounted for histologically only by the hydrosalpinx of the right tuba uterina, sclerotic changes in the ovaries, and cystic degeneration of ovarian follicles. The cervical changes observed grossly were not expressed microscopically. The case exemplifies further the close relationship existing between ovarian function and sterility.

Case 10

Clinical History.—Four-year-old Holstein cow. Past history unknown. Physical examination revealed an occluded vagina, so extensive that slaughter was advised.

Necropsy.—Gross Description.—The vagina is closed just anterior to the urethral orifice. The stricture appears to be the result of an inflammatory reaction which brought the vaginal walls into close apposition and united them by scar tissues formation. The central part of the stricture presents an opening 3 mm. in diameter, communicating with the anterior vaginal structures. Anterior to the stricture the vagina is 1.5 cm. in

diameter, enlarging again at the external os uteri so as easily to accommodate this structure. The cervix uteri and uterus appear normal excepting for an enlarged and flaccid right horn. The right tuba uterina is enlarged to 8 mm. in diameter and contains a clear, straw-colored fluid. The lumen is crossed by strands of adherent mucosal folds, so that it is multilocular in appearance. The left tuba uterina is normal. The right ovary presents a cyst 2 cm. in diameter containing a clear, straw-colored fluid which coagulates upon leaving its cavity. The inner wall of the cyst is yellow to a depth of 2 mm. The left ovary is normal.

Microscopical Description.—The vaginal epithelium is irregularly exfoliated and is chronically infected. The cervix is normal. The corpus uteri shows extensive atrophy and fibrous replacement of uterine glands. Chronic infection is also exhibited. The cornua uteri present but mild changes, expressed by an edematous stroma, and maceration of superfical glands of the endometrium. The left tuba uterina is normal. The right tube is dilated at its ampulla and corresponds histopathologically to the descriptions previously given for hydrosalpinx, excepting that there is no adhesion of folds. The mucosal structures are flattened out and lie against the wall. A few normally appearing folds remain. The right ovary shows fibrosis of its stroma. Some follicles are degenerated, as exhibited in one by atrophy of membrana granulosa and theca folliculi, with proliferation of connective tissue about the ovum, entirely obliterating the cumulus oöphorus. The liquor folliculi is of increased density. Sections through the large corpus luteum cyst show an inner thin, edamatous, connective tissue lining, beneath which organized luteal tissue exists. The left ovary is normal.

Bacteriological Findings.—All organs found sterile excepting right cornu uteri, which gave a growth of *Staphylococcus epidermidis.*

Diagnosis and Discussion.—Stricture of the vagina, mild chronic proliferative changes of corpus uteri, with atrophy of glands, right hydrosalpinx, atretic and cystic degeneration of right ovarian follicles, and right corpus luteum cyst. Sterility in this case would have been absolute, with only the vaginal lesions. The uterine changes, and hydrosalpinx as is the vaginal change too, are the end result of chronic infection. The

presence of staphylococci in the right cornu uteri may be an expression of this passing infection.

Case 11

Clinical History.—Scrub cow, age 3½ years, used as control in the University infectious abortion project. Animal never reacted positively to agglutination test for infectious abortion. The animal was always difficult to get with calf. A normal calf was born at the age of 2½ years. A second calf was born normally at the time of this study, but died three days following birth. The cow developed, within the first week post partum, a mild, purulent vaginal discharge. The animal was slaughtered in order to complete the records, and study was undertaken to determine, if possible, the etiology of the infection and pathologic changes coincident with it.

Necropsy.—Gross Description.—The vagina contains considerabl viscid mucous discharge streaked with pus. The cervix is normal. The endometrium of the uterus is deeply congested and the lumen contains a bloody purulent exudate. The carunculæ are large and prominent. The uterine tubes and ovaries are normal.

Microscopical Description.—The uterine wall is infiltrated with pus cells and the vessels are filled with blood. Some red blood cell extravasation exists. There is mild desquamation and necrosis of lining epithelial cells. The uterine tubes are actively congested. The right ovary is normal. The left ovary shows several atretic and cystic follicles. The cystic change is as before described.

Bacteriological Findings.—Uterus, *Streptococcus viridans* (Alpha type), *Staphylococcus epidermidis, Staph. aureus, Sarcina lutea, Torula rosea.* Uterine tubes and ovaries are sterile.

Diagnosis and Discussion.—Mild puerperal endometritis. No evidence of permanently damaged genitalia exists.

Case 12

Clinical History.—Holstein cow, age 7 years. Gave birth to calf at 2 years of age, and since that time has had irregular estral periods and always failed to conceive. Abortion disease not prevalent in the herd from which she came. Necropsy obtained.

Necropsy.—Gross Description.—All structures appear normal.

Microscopical Description.—The uterine epithelium in places is hyperplastic and hypertrophic. In these areas the cells are stratified to 6 or 8 layers in depth. The uterine tubes are normal. Both ovaries present many Graafian follicles exhibiting the following changes: The cells of the membrana granulosa are degenerated with pyknotic nuclei. The normal light liquor folliculi is replaced by a dense coagulum taking a neutral stain. The cells of the cumulus oöphorus are for the most part degenerated. The ovum presents a hyaline eosin-staining structure. Other follicles show a dense liquor folliculi with stretching and pressure atrophy of the membrana granulosa.

Bacteriological Findings.—All cultures from cervix, uterus, tubes and ovaries remained sterile.

Diagnosis and Discussion.—Bilateral cystic degeneration of ovarian follicles. These changes are the only ones, histologically, sufficient to produce continued sterility.

Case 13

Clinical History.—Holstein heifer, age 2 years, without history of disease. Physical examination revealed an occluded vagina and undeveloped uterus, round sac-like structures, connected with ovaries. Slaughter advised. Necropsy obtained.

Necropsy.—Gross Description.—The vagina is 5 cm. in length, being occluded at that point by union of its walls. From this point the uterus is represented only by nearly solid cords, bound beneath a single areolar sheath. The length of these tubes as they run parallel to one another is 30 cm. At this point they divide into right and left and proceed forward and outward approximately 14 cm. At this point each enlarges into a partially developed thin-walled sac containing a turbid yellow-colored fluid. The right sac measures 9 by 10 cm. and the left 9 by 5.5 cm. The tubæ uterinæ are normal. The ovaries are large and contain many follicles possessing a semi-solid white liquor folliculi. The left ovary in addition presents a normal corpus luteum.

Microscopical Description.—Sections through the remains of the Müllerian tubes show a low cuboidal epithelial lining. Beneath this the connective tissue is dense and for the most part collagenous in type. Smooth muscle bundles are unevenly distributed through the connective tissue stroma. In the partially developed uterus the mucosa is lined throughout with a low

Fig 1—Normal follicle, Case 2, showing ovum surrounded by the cells of the cumulus oophorus. Note the granular character of the liquor folliculi coagulum.

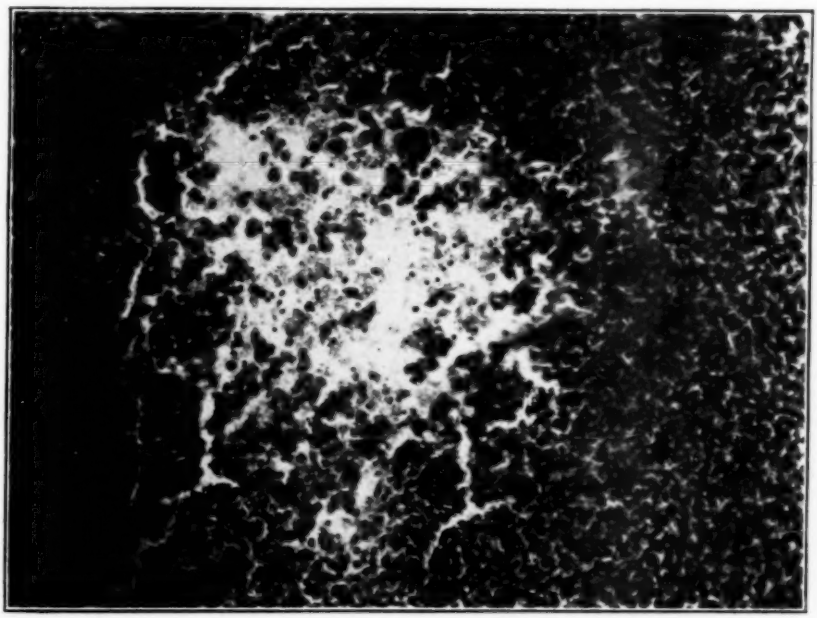

Fig 2.—Graafian follicle, Case 1, showing degenerative change. Note thickening of stratum granulosum and theca folliculi.

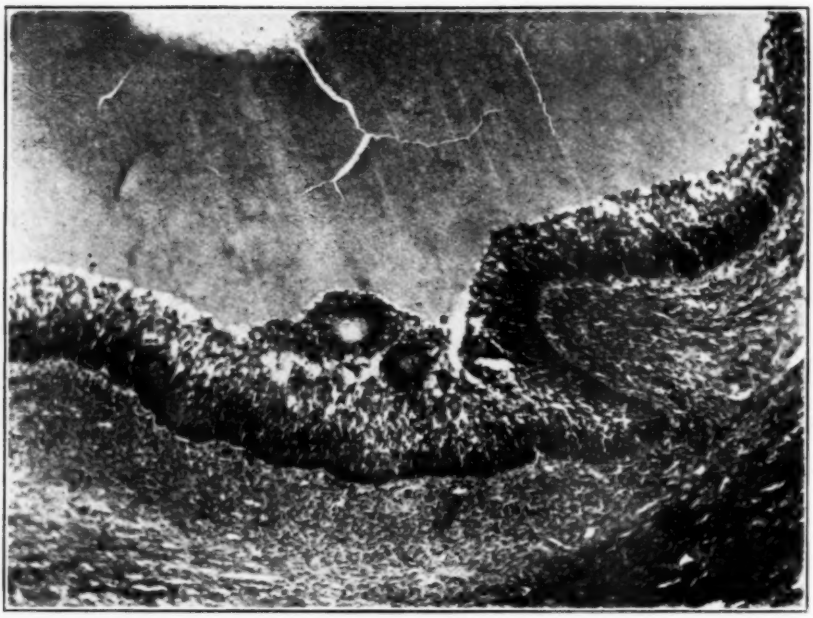

Fig 3.—An example of cystic degeneration of Graafian follicle, Case 5. Note dense coagulum replacing normal liquor folliculi and degenerative changes in cells of stratum granulosum (not marked in this case).

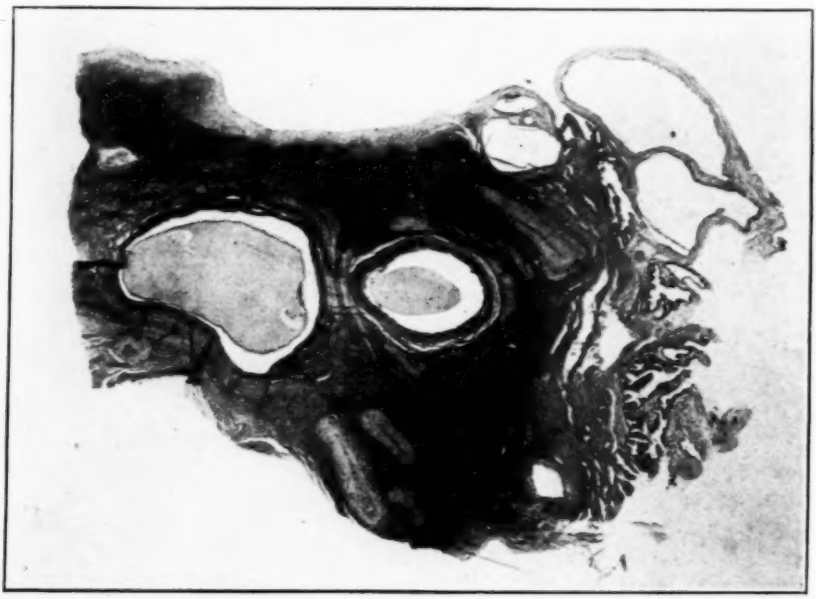

Fig. 4.—Section through ovary, Case 9. Note uterine tube adherent to ovary, the multilocular cavities characterizing hydrosalpinx. Two Graafian follicles showing cystic degeneration are seen in the ovary, also corpora albicantia.

Fig 5.—Low power of uterine tube, Case 5. Hydrosalpinx, early stage.

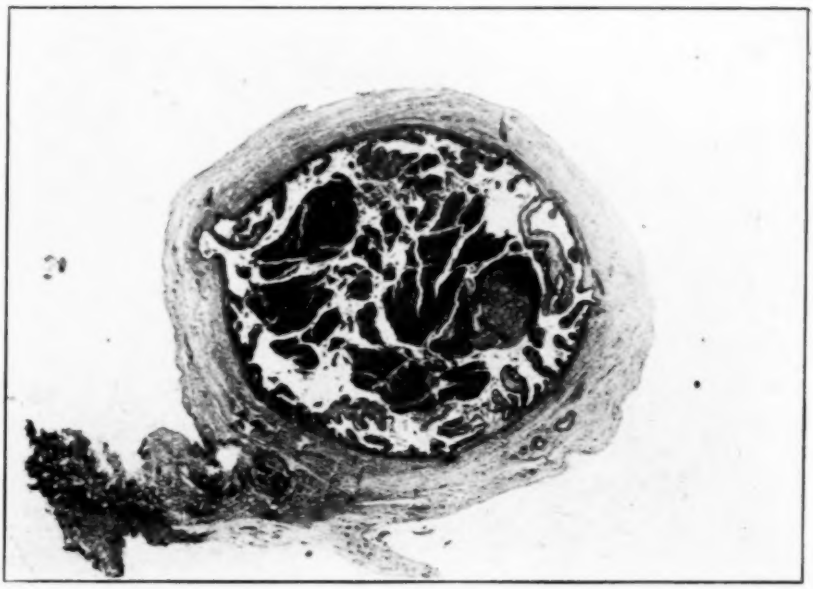

Fig. 6.—Purulent salpingitis, Case 2. Low-power section of uterine tube. Note the purulent exudate in the lumen.

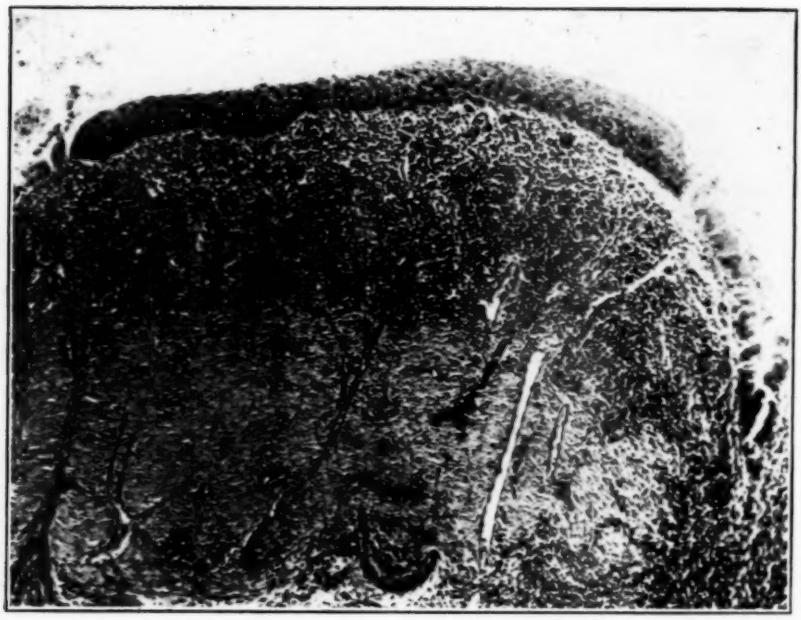

Fig. 7.—Section through caruncula, Case 7. Note great thickening of uterine epithelium. Stratified over caruncula and simple columnar at the border. "Ectodermoisering."

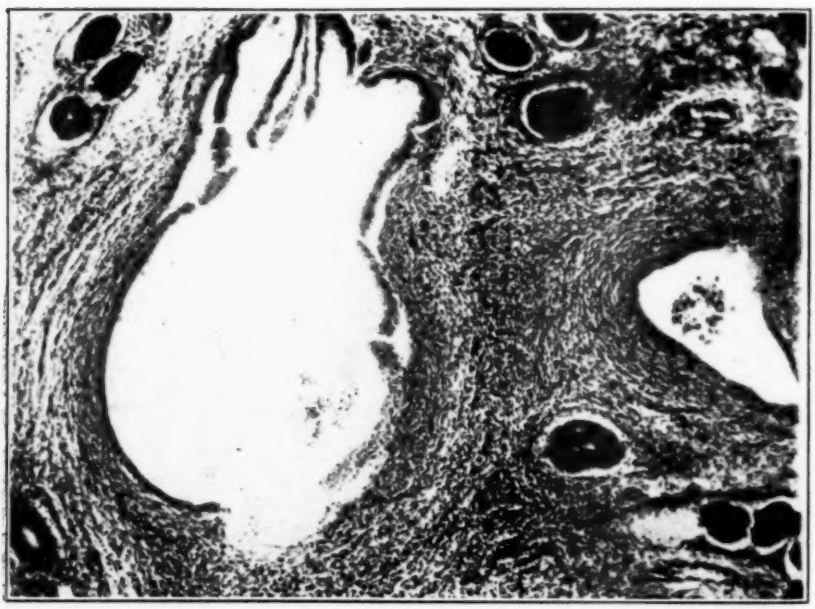

Fig. 8.—Dilated uterine glands, Case 2. There is considerable destruction of the glandular epithelium. Other deeply stained glands in same section remain normal.

Fig 9.—Section through wall of uterus, Case 7. Note fibrosis of uterine stroma, dilation of uterine glands and atrophy of glandular epithelium.

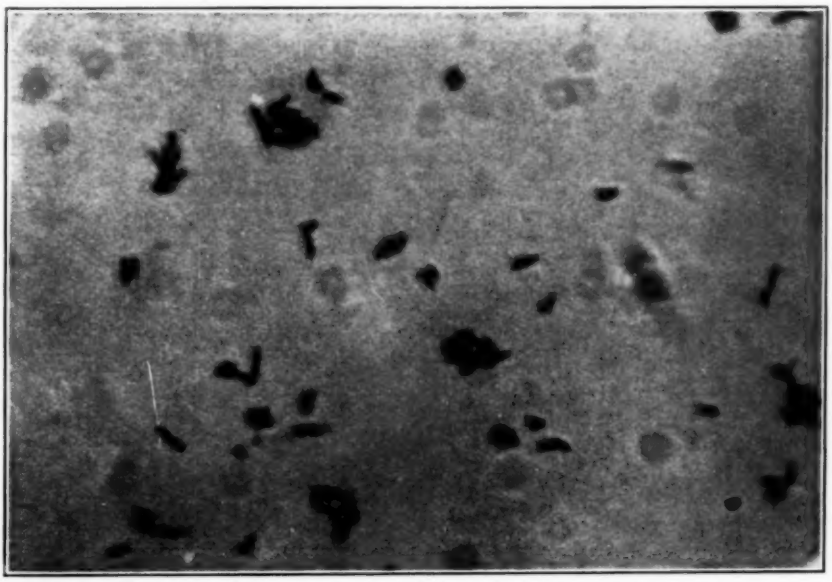

Fig 10.—Bacillus pyogenes, Case 18. Note the characteristic clusters, parallel grouping and diphtheroid types.

Fig. 11.—Gross specimen, genitalia, Case 4. Shows extensive periuterine abscesses.

type of epithelium, stratified in most instances. The epithelium of the glands is macerated. The walls are thin and very edemic. The muscular coat is especially undeveloped. The uterine tubes are normal. In the ovaries medium-sized Graafian follicles are exceedingly numerous. These exhibit quite uniformly a theca folliculi of increased thickness, a quite normally appearing membrana granulosa and a liquor folliculi of increased density, staining neutral. In the sections studied no ova are seen.

Bacteriological Findings.—Cultures prepared from the partially developed uterus, tubes and ovaries remained sterile.

Diagnosis and Discussion.—A case of absolute sterility from partially arrested development of the genitalia. Multiple cystic degeneration of the follicles as described in this case are frequently seen in the ovaries of young girls. They correspond histologically to the cystic changes described for ovaries in other cases herein reported.

Case 14

Clinical History.—Similar to Case 13.

Necropsy.—Gross Description.—This corresponds almost identically to that described for Case 13.

Microscopical Description.—Essentially the same as for Case 13.

Bacteriological Findings.—All cultures from various areas remained sterile.

Diagnosis and Discussion.—Partial arrested development of the genitalia and cystic degenerative changes of the Graafian follicles.

Case 15

Clinical History.—Aged Holstein cow. Normal calf delivered November, 1920. Parturition was difficult owing to a breach presentation. Severe purulent metritis and cervicitis soon followed. Cultures from the cervix and uterus gave the following growths: *Bacillus pyogenes, Streptococcus pyogenes* (Beta type), *Staphylococcus aureus.* The animal responded to the treatment employed so that within four months her condition was apparently normal. Pregnancy had not yet occurred at end of seventh month following parturition. (Note: This animal is in calf from December 4, 1921, service.)

Diagnosis and Discussion.—Purulent cervicitis and metritis, acute in type, and caused by *Bacillus pyogenes, Streptococcus pyogenes* and *Staphylococcus aureus.*

Case 16

Clinical History.—Aged Guernsey cow. Delivered a normal calf in June, 1920. The placenta was retained, following which a severe purulent metritis developed. The owners gave the animal but little attention until January, 1921. Examination at this time revealed a deeply seated corpus luteum in the right ovary. The cervix uteri was inflamed and the cervical canal partially open. The uterus was enlarged, flaccid, and abdominal in position. The persistent corpus luteum was enucleated four days later. The uterus then contracted and within 24 hours had expelled 4 to 5 liters of pus. The pus was malodorus. Cultures prepared from this material revealed two types of organisms, *Bacillus pyogenes* and *Streptococcus viridans* (Alpha type). Recovery was progressive and regarded as complete after two months. Examination in May, 1921, revealed the development of a right tubo-ovarian abscess. The animal, although bred, was not pregnant.

Diagnosis and Discussion.—Pyometra, cervicitis, and tubo-ovarian obscess, the etiology of which is *Bacillus pyogenes* and *Streptococcus viridans.*

Case 17

Clinical History.—Holstein cow, age 5 years, produced a normal calf in November, 1920. Following parturition the placenta was retained. Purulent metritis developed, but received no special attention until March, 1921. Examination revealed cervicitis, an extensive pyometra, cystic left ovary and corpus luteum in right ovary. The cyst was ruptured and corpus luteum enucleated. Maladorous, thick, creamy pus began to flow freely from the vagina within 24 hours. Swabs taken of the purulent exudate gave growths of *Macillus pyogenes* and *Staphylococcus epidermidis.* Recovery was rapid, the exudate having practically cleared away at the termination of two weeks. Later sold at public sale as a healthy individual.

Diagnosis and Discussion.—Pyometra and cervicitis following parturition caused by *Bacillus pyogenes* and *Staphylococcus epidermidis.*

Case 18

Clinical History.—Holstein cow, age 6 years. Delivered a normal calf in November, 1920. The placenta was retained following parturition, but was promptly removed. A purulent

metritis followed, but received no attention until March, 1921. Physical examination at this time revealed an elongated, large uterus and large, persistent corpus luteum. The corpus luteum was enucleated, following which large quantities of pus were discharged from the uterus. Cultures prepared from this exudate gave growths of *Bacillus pyogenes, Streptococcus viridans* (Alpha type), *Streptococcus* (Gamma type), *Staphylococcus aureus* and *Staphylococcus epidermidis.* Recovery was apparently complete at the end of one month.

Diagnosis and Discussion.—Cervicitis and pyometra, the etiologic agents of which may be considered as *Bacillus pyogenes,* streptococci and staphylococci. This animal is now pregnant.

Case 19

Clinical History.—Not obtainable. Necropsy secured.

Necropsy.—Gross Description.—Vagina and cervix are normal. The uterine horns are much deformed and irregularly enlarged. Sections through the walls reveal multiple tubercle formation, with slight floculent, yellowish exudate in the uterine lumen. Both uterine tubes present closed and enlarged abdominal stromata, the walls at these points being hard and studded with partially necrotic, partially calcified tubercles. The ovaries are normal. The pelvic peritoneum is diffusely studded with tiny miliary tubercles.

Microscopical Description.—The uterus exhibits many tubercles throughout the wall, especially in the endometrium. These are composed of areas of central necrosis, lymphocytic zones and endothelioid cell formations about the necrotic central portion. Giant cells are also seen. The stroma of the endometrium is densely infiltrated with lymphocytes. A few glands are dilated, but for the most part they are normal. The larger tubercles are well encapsulated with connective tissue. The uterine tubes are practically destroyed by the tuberculous process, excepting near the isthmus, where they remain normal. The ovaries are normal.

Diagnosis.—Advanced generalized miliary tuberculosis with tuberculous metritis and salpingitis. Smears stained for *Bacillus tuberculosis* were positive.

Experimental Inoculation with Bacillus Pyogenes

Space will not permit detailing these experiments. Two attempts to infect heifers with fresh cultures of *Bacillus pyogenes*

met with failure. In one instance, in a pregnant heifer, inoculations into the blood stream were made without result. The calf was delivered normally and subsequent necropsy of the subject revealed normal genitalia. In another case fresh cultures were injected into the cavity of the uterus. No infection resulted, as was shown by necropsy findings. These experiments illustrate the resistance of the normal genital tract to such types of infection and the necessity of a predisposing factor.

Serological Studies with Bacillus Pyogenes

Two rabbits were immunized with separate strains of *Bacillus pyogenes*. Serum from these rabbits agglutinated all strains of the organism to an equal degree. The cultural studies confirm this close relationship of type.

DISCUSSION

It is confusing in interpreting results in Table 1 to have such a large group of streptococci. All strains, excepting *Streptococcus pyogenes* and *Streptococcus anginosus* are of the nonhemolytic (Alpha and Gamma types). These two, however, fall into the group of hemolytic streptococci. (Beta type.)

It will be seen after careful study of the material presented that the organisms most important in infections of the genital tract of the cow are streptococci and *Bacillus pyogenes*. These types are responsible for the greater number of infections. In all cases of severe nonspecific metritis and other suppurative processes about the genitalia *Bacillus pyogenes* combined with streptococci, or the latter alone, have been isolated. Other organisms are not regarded as playing a primary rôle. Unless the bacteriologic study is made during the progress of active infection, these types as well as others will most often not be found. In such cases one views only the results of infection, the active process having subsided. It is for this reason that in nearly all cases when no gross evidence of active inflammation exists the genital tract is sterile. The vagina, cervix uteri and corpus uteri must be excepted.

Organisms are not harbored as commensals normally in the internal genitalia of the cow, with exceptions as already made. Case 6 is an unparalleled example of this. Hydrosalpinx, the end result of active inflammation, existed, cultures from which were sterile. Case 10 also illustrates the point. Many other

TABLE 1.—SUMMARY OF BACTERIOLOGICAL FINDINGS

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Genital organ	Case Number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Vagina	1 5 14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Os uteri externum	1 5 14	X	X	X	X	1 2 5	1 10 13	1 2 4	3	0	X	X	Y	Y	11 13	13 15	13 15	1 3 13 15 19	X
Corpus uteri	0	3 5 12 13	0	0	0	1 2 5	X	1 2 4	0	0	1 3 15 17 19	0	Y	Y	11 13	13 15	13 15	1 3 13 15 19	20*
Right cornu uteri	0	3 5 12 13	13	0	13	0	3 10 13	1 2 4	12	3	1 3 15 17 19	0	0	0	X	X	X	X	20*
Left cornu uteri	0	3 5 12 13	0	0	0	0	3 10 13	1 10	0	0	1 3 15 17 19	0	0	0	X	X	X	X	20*
Right uterine tube	0	3 5 12 13	0	0	4 9 13	0	3 10 13	0	0	0	0	0	X	0	X	X	X	X	20*
Left uterine tube	0	3 5 12 13	X	X	0	0	3 10 13	0	0	0	0	0	X	0	X	X	X	X	20*
Right ovary	0	2 12	0	0	0	0	3 10 13	0	0	0	0	0	0	0	X	X	X	X	X
Left ovary	X	0	X	X	0	0	0	0	0	0	0	0	0	0	X	X	X	X	X
Ovarian cysts	0	0	0	0	13	0	0	4	0	0	0	0	0	0	X	X	X	X	X
Ovarian abscess	Y	2 12	Y	Y	13 9	Y	3 10 13	Y	Y	Y	Y	Y	Y	Y	X	X	X	X	X
Periuterine abscess	Y	Y	7 13	4 8 13 16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	X	X	X	X	X

Explanation of Symbols:

0, Sterile.
X, Not cultured.
Y, Structure not present.
1, *Staphylococcus aureus.*
2, *Staph. auranticus.*
3, *Staph. epidermidis.*
4, *Staph. candidus.*
5, *Bacillus coli communis.*
6, *B. coli communior.*
7, *Streptococcus anginosus.*
8, *Strep. fecalis.*
9, *Strep. ignavus.*
10, *Strep. nonhemolyticus ii.*
11, *Strep. pyogenes.*
12, *Strep. mitis.*
13, *Bacillus pyogenes.*
14, *B. subtilis.*
15, *Strep. viridans.*
16, *Bacillus proteus.*
17, *Sarcina lutea.*
18, *Torula rosea.*
19, *Streptococcus* (Gamma type).
20, *Bacillus tuberculosis.*
*, Stain only.

TABLE 2.—SUMMARY OF BACTERIOLOGIC RESULTS INCLUDING ALL CASES

Organism	Times found	Case Number																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Streptococcus, Alpha type	8	−	+	−	+	+	−	−	−	+	−	+	−	−	−	−	+	+	+	−
Streptococcus, Beta type	2	−	−	+	−	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−
Streptococcus, Gamma type	4	−	−	−	−	−	−	+	+	−	−	+	−	−	−	−	−	−	+	−
Bacillus pyogenes	9	−	+	+	+	+	−	+	−	−	−	−	−	−	−	+	+	+	+	−
Staphylococcus aureus	6	+	−	−	−	−	+	+	+	−	−	+	−	−	−	−	−	−	+	−
Staphylococcus, all other types	10	−	+	−	+	+	+	+	+	+	+	+	−	−	−	−	−	−	+	−
Bacillus coli	3	+	+	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−
B. tuberculosis	1	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+*
B. proteus	1	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Sarcina lutea	1	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−
Torula rosea	1	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−

* Bacillus tuberculosis, by stain; organs not cultured.

TABLE 3.—SUMMARY OF BACTERIOLOGIC RESULTS IN CASES OF SUPPURATION

Organism	Times found	Case Number											Per cent present
		2	3	4	5	7	11	15	16	17	18	19	
Bacillus pyogenes	9	+	+	+	+	+	−	+	+	+	+	−	81.8
Streptococcus, Alpha type	7	+	−	+	+	−	+	−	+	+	+	−	63.6
Streptococcus, Beta type	2	−	+	−	−	−	−	+	−	−	−	−	18.1
Streptococcus, Gamma type	3	−	−	−	−	+	+	+	−	−	+	−	27.2
Staphylococcus aureus	3	−	−	−	−	+	+	+	−	−	+	−	27.2
Staphylococcus, other types	6	+	−	+	+	+	+	−	−	−	+	−	54.5
Bacillus coli	2	+	−	−	−	+	−	−	−	−	−	−	18.1
*B. tuberculosis**	1	−	−	−	−	−	−	−	−	−	−	+	9.0
B. proteus	1	−	−	+	−	−	−	−	−	−	−	−	9.0

* By stain only; cultures not made.
Case 11, mild puerperal metritis of short duration; healing would probably soon have occurred.
Case 18, tuberculous metritis and salpingitis.

examples of a bacteria-free genital tract may be found in the case reports and as compiled in Table 1. The absence of *Bacillus abortus* (Bang) supports the previous view, that it is not found in puerperal infections that persist for any length of time, and that it does not persist, so far as is known, in the genitalia of the cow. *B. abortus* was not isolated from any of the cases studied.

The frequency with which one views degenerative changes in the ovaries of sterile cows can not be disregarded. It seems that in all cases of infection about the genital tract, multiple cystic degeneration of medium-sized Graafian follicles is an almost constant finding. Until more study is made, especially on normal animals as controls, no definite statement can be made. The uterine tubes, because of their many folds and crypts and their delicate structure, offer the most favorable site for persistence of infection. Chronic changes in the genital tract are most frequent in this location and are nearly always seen in the form of hydrosalpinx. In the uterus chronic changes do not readily occur. Only after severe infection over a long period of time are sufficient changes produced to render the organ incapable of serving its natural use. It does not seem as readily susceptible to persistence of infection as do the uterine tubes. The changes noted in the uterus are fibrosis, dilation of glands, atrophy of glandular epithelium, thickening of uterine epithelium, etc. The cervix uteri, like the uterine tubes, offers a favorable site for bacterial reproduction. The folds of the mucosa are deep and in the crypts bacteria may gain entrance and multiply. Although accessible to treatment, the deep crypts allow infection to persist and often to extend to other portions of the genital tract. Hypertrophy of the cervical folds is the most constant chronic change. The vagina, because of its smooth, stratified epithelial surface, is not readily infected. It may harbor pathogenic types of bacteria, as commensals, on its surface, in its accessory glands, in the subepithelial lymph follicles or in the urethral orifice. It is suggested that the vagina and accessory structures are the reservoir for organisms which infect the genital tract of the cow, including *Bacillus abortus* and other types which cause congenital (prenatal) infections. The route of infection may be through the lymphatic system, which is most highly developed about the female genital

tract. The occurrence of parauterine and periuterine infections seems to support this view.

A total of nineteen cases have been studied and presented. The theory of infection does not explain all cases of sterility. Where no evidence of infection, past or present, exists, and the animal is sterile, the ovaries must be looked to as often the cause of the condition.

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STUDIES OF BIOLOGICAL PREPARATIONS BY COMPLEMENT-FIXATION METHODS

I. MALLEIN: ANTIGENIC VARIATIONS AND A PROPOSED METHOD OF STANDARDIZATION [1]

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THE constantly increasing manufacture and sale of biological products, the various and often extravagant and unsustained claims that are made for their potency, superpotency and "careful standardization" (?), the divergent or conflicting testimony and opinions with regard to the employment and values of many of these products, all seem to emphasize the need of State or Government control and more satisfactory and accurate methods of fixing standards of potency.

We believe that these standards can best be fixed and expressed in terms of units of antigen or antibody, and that complement-fixation reactions obtained with a specific antiserum for the biological product under consideration offer a satisfactory method of standardization, more scientific, more uniform and more precise than any of the methods hitherto employed.

Present methods of standardizing tuberculins are based on Koch's discovery of the reaction of tuberculous animals to an injection of tuberculin. A series of guinea-pigs is used for the standardization tests. There are many drawbacks, however, to this method, with which all who practice it are familiar; such as, for example, the time and labor involved, the varying degree of sensitization, individual susceptibility and resistance, and the large number of animals required. The final reckoning, moreover, does not permit of an exact determination of the activity of the product.

As regards suspensions of living or dead bacteria, their potency, standardization and dosage seem to be based largely upon the bacterial count. Great stress is laid upon a "high bacterial count" in respect to many vaccines and bacterins put

[1] Published by permission of Dr. F. Torrance, Veterinary Director General, Ottawa.

on the market, as if that were the main indicator of their potency and antigenic value.

The virulence, purity and age of the cultures, the composition of the media on which they are grown, the methods and agents used in attenuating or killing them, and the action of preservatives are factors of premier importance. In short, every manipulation and step in preparation is apt to influence strongly the properties of the completed product.

One suspension of relatively few organisms may, according to the manner of preparation, have very high antigenic properties, while another with ten, twenty or even a hundred times the number of bacteria present in it, but prepared and treated in a different manner, may possess an infinitesimal amount of specific antigen.

Discrepancies as regards the determination of antigenic values are common to all products, irrespective of the method used for standardization, whether it be by the weight or count of the bacteria, the opacity test, or by the use of the nephelometer. The true antigenic properties of any preparation must be those present in the finished product and determined by specific immunity reactions.

We have begun our researches on mallein, mainly for the reason that no uniform satisfactory method for the standardization of this product has been evolved. The activity of an untried mallein may be indicated by injecting a glandered horse with a diagnostic dose. But it is dangerous and undesirable to maintain glandered horses for such a purpose. Tests on small laboratory animals are of little and questionable value. Nocard (1)[1] found that 1 c.c. of crude mallein was sufficient to kill a rabbit. We have been unable to kill rabbits with the same and double the dose mentioned with both crude mallein and its equivalent in diluted mallein. Hutyra and Marek (2) say:

> Experimentally infected guinea-pigs react both locally and generally to injections of 0.2 to 0.5 gm., while the injection of 2.0 gm. into healthy guinea-pigs produces only temporary elevation of temperature. (Pearson.)
>
> The effectiveness of mallein varies according to the virulence of the strain of bacilli as well as to the method according to which it has been prepared. At present we have no reliable methods of standardizing this material aside from its practical application in testing glandered horses.

[1] Numerals in parentheses after authors' names refer to list of literature at end of paper.

The only attempt, so far as we have been able to ascertain, to standardize mallein in vitro was made by Fava (3). Comparing the activity of various malleins by the precipitin test and by the intracerebral injection in guinea-pigs, he found that the precipitin test was much more delicate for estimating the activity of mallein.

We have employed precipitin tests in our preliminary experiments and found the method unsatisfactory for comparative titrations. Much difficulty is frequently experienced in reading the reactions, which, with the wide allowance that must be made for individual interpretation, has led us to discard this procedure and to employ the less arbitrary, if more arduous, complement-fixation test, following Watson's modification (4). The complement-fixation test is generally accepted as a very reliable diagnostic test for glanders; in fact, it may be said to be the most accurate test known in this respect; but as it is entirely a laboratory test, it has not superseded the mallein field test, but is used as an auxiliary to it, especially in connection with a questionable mallein reaction.

In employing the complement-fixation test, however, it was very soon recognized that there was a possible source of error in that horses previously injected with mallein are prone to give positive reactions (fixation). In other words, horses could be sensitized to mallein, the sera of such horses containing specific antibodies which would react to mallein or other glanders antigens when brought together in proper combination. This phenomenon has been much studied, and in accordance with the experiments and observations of different workers, varying periods of time have been mentioned for the appearance and disappearance of these antibodies in the blood sera of horses and for the interval between malleination and a serum test.[1]

With these facts in mind we set to work to hyperimmunize a horse to mallein with the object of obtaining an antiserum which could be utilized for an exact method of titration, and thereby the standardization, of mallein or the products of *Bacillus mallei*.

[1] *Author's note on going to press:* A paper by Brocq-Rousseu, P. Forgeot and A. Urbain, "Sur la formation des anticorps à la suite des injections de malléine" (Ann. Inst. Past., vol. 35, Dec., 1921), has just come to hand. The formation, duration and richness of antibodies in malleined horses is shown by experiments. Forty-five days is given as the necessary interval between malleination and a complement-fixation test.

ANTIMALLEIN SERUM

The mallein used for immunization is the product of the Biological Laboratory, Ottawa, and from the same stock that is distributed to veterinarians for the diagnosis of glanders in horses. A normal horse received subcutaneous injections of this mallein at intervals of from seven to fourteen days, commencing June 10, 1921. After four injections of 2.5, 5, 7.5 and 10 c.c. respectively, spread over a period of four weeks, a serum was obtained which in a dose of 0.1 c.c. fixed one unit of complement in the presence of 0.1 c.c. of dilute mallein.

Continuing immunization with increasing doses of mallein, serum obtained after the fifth injection of a 12.5 c.c. dose, and again seven days after the sixth injection of a 15 c.c. dose, gave likewise fixation in a dose of 0.1 c.c. After the seventh injection of a 17.5 c.c. dose, an interval of sixty days elapsed without further injections. A serum test at this time showed a marked reduction in antibody content. A further injection, the eighth, of 20 c.c. mallein was given. Nine days later the complement-fixing unit of the antimallein serum was raised to 0.04 c.c.—that is, 25 units per cubic centimeter. A final injection, the ninth, of 20 c.c. mallein, was given after forty days. This raised the titer of the serum to 0.01 c.c. (100 units per cubic centimeter). This titer of the antiserum was maintained without further injections of mallein for twenty-seven days, when it gradually declined from 0.01 c.c. (100 units) to 0.06 c.c. (16.6 units) on the fifty-third day, continuing without further reduction to the ninety-third day, after which a further gradual decline was registered, namely, 0.08 c.c. (12.5 units) on the 107th day, 0.1 c.c. (10 units) on the 119th day, 0.13 (7.7 units) on the 127th day and 0.14 (7.1 units) on the 147th day. (See accompanying diagram.)

ELIMINATING NONSPECIFIC FIXATION

As soon as a serum that would fix complement in the presence of mallein was obtained, the question of specificity presented itself. Since the media on which *Bacillus mallei* is cultivated contain a variety of proteins, there was a possibility of these acting as antigens instead of, or in addition to, the specific product of the organism. We found, however, that glycerin-bouillon, identical with the culture medium in which *B. mallei* is grown for the production of mallein in our laboratory, did

not cause any fixation of complement when used as antigen in the same and double the amounts of mallein antigen, nor with a double dose (0.2 c.c.) of the antimallein serum.

Other biological products such as tuberculin and blackleg filtrate were also employed as antigens, but caused no fixation of the complement. Although there may be some bacteria or bacterial product with antigenic properties similar to those of mallein and capable of combining with antimallein horse serum to fix complement, we have not encountered it thus far in our studies. Moreover, our main object was to eliminate only nonspecific fixation that might have been caused by the presence in the culture medium of constituents other than the specific products of the *B. mallei*.

Apropos of nonspecific fixation, we observed a curious fixation phenomenon with the sera of normal rabbits. Among the animals immunized for the production of antimallein serum were two rabbits. Serum collected from one of them after five inoculations fixed in a 0.1 c.c. dose, one unit of complement in the presence of 0.1 c.c. of mallein. The serum of the normal rabbit control likewise fixed complement in the same amount. A repetition of the test gave the same results.

To clear up the matter we collected sera from six healthy rabbits. The rabbits were chosen at random from our pens and bled from the ear. The blood was defibrinated and centrifuged and the clear serum was inactivated at 58–60° C. for half an hour. All these sera fixed one unit of complement in amounts of 0.1 c.c., in degrees varying from one plus to four pluses, when mallein and tuberculin were used as antigens in quantities of 0.1 c.c. Using ordinary glycerin-bouillon as a control antigen in the same amounts, the fixation reactions were weakened, and with one serum there was no fixation at all. Table 1 shows the comparative degrees of fixation obtained with mallein, tuberculin and glycerin broth as antigens.

In all of our complement-fixation tests we have used the "rabbit antisheep" hemolytic system. As natural hemolytic amboceptors for sheep cells are present in normal rabbit serum, it might be thought that the addition of rabbit serum (as the test serum) would favor hemolysis. In practice, however, the opposite reaction seems to take place, complement being deviated and hemolysis correspondingly inhibited.

It would appear that when both the test serum and the hemo-

TABLE. 1—NONSPECIFIC FIXATION REACTIONS WITH RABBIT SERA AND DIFFERENT ANTIGENS

Serum		Antigens		Controls		
Rabbit No.		Mallein	Tuberculin	Glycerin-bouillon	Antigen	Serum
First test						
1	Antimallein	++++			−	−
2	Normal	++++			−	−
Second test						
3	Antimallein	++++	++++		−	−
4	Antituberculin	++++	++++		−	−
Third test						
5	Normal	++++	++++	++++	−	−
6	Do.	+++	+++	+	−	−
7	Do.	++++	++++	+++	−	−
8	Do.	+	++	−	−	−
9	Do.	++++	++++	+++	−	−
10	Do.	+++	+++	+	−	−

In the foregoing table and elsewhere in this paper we have indicated the range of reactions between complete hemolysis and complete fixation by the six signs, −, +−, +, ++, +++, ++++.

lytic serum are derived from rabbits a precipitin reaction comes into play and causes deviation or absorbtion of complement to a greater or less degree. In fixation tests of rabbit serum the "rabbit antisheep" hemolytic system should therefore not be used, and in all complement-fixation tests it is desirable that the three animal species represented by the complement, red cells and sensitizing serum of the hemolytic system should not include the animal species represented by the test serum.

Kolmer and Trist (6) have studied nonspecific fixation by normal rabbit serum and conclude by saying: "It is to be emphasized that when rabbits are employed for experimental studies with a view to using their sera for complement-fixation tests, their sera should be tested one or more times, before inoculation, preferably with the particular antigen to be used, and only those selected that react negatively."

THE UNIT SYSTEM

If the value or strength of antisera and antigens can be determined in vitro by laboratory tests and indicated in terms of units, it follows that comparisons, valuations and the fixing of standards become much simplified and easily read.

Calmette and Massol (5) employed a unit system in which one unit of antiserum was represented by the minimum dose of complement required in their particular hemolytic system.

The number of such minimum doses of complement deviated by 1.0 c.c. of antiserum plus antigen represents the unit value of the antiserum. The determination is made in a series of tests using fixed amounts of antiserum and increasing amounts of complement. The maximum amount of deviated complement divided by the minimum dose gives the number of units.

Our own unit system is one in which one unit of antiserum is represented by the minimum dose of that serum which can completely fix one minimum dose of complement required in our hemolytic system, the determination being made by using only one exact unit of complement (the minimum dose) with decreasing amounts of antiserum plus the antigen. It necessarily follows that the accurate titration of the complement (4) is most important and essential, a point which can not be emphasized too much. The diagram shows the minimum dose,

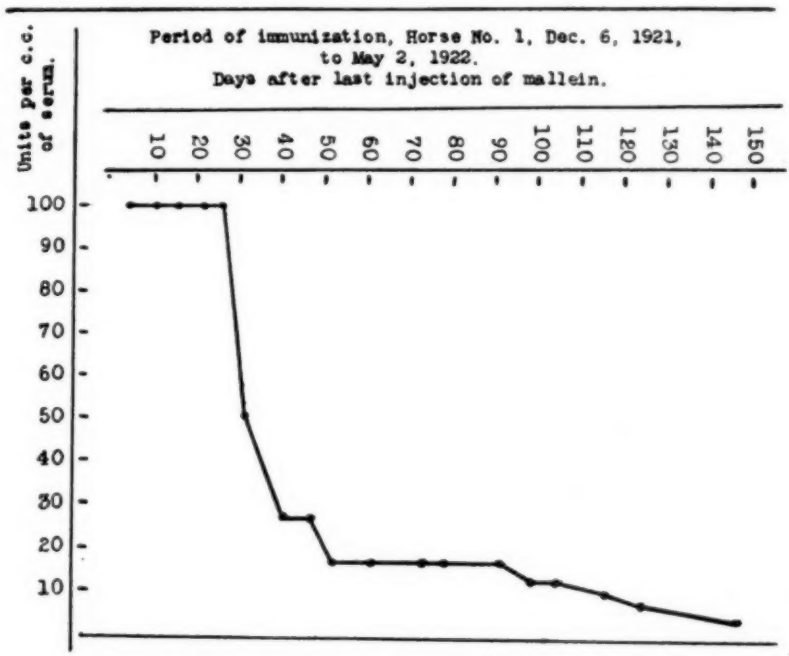

Diagram showing duration of sensitization to mallein.

or one unit (and the computed number of units per cubic centimeter) of antiserum fixing one unit of complement in the presence of 0.1 c.c. of mallein. Eighteen series of tests were made with the 18 different samples of serum obtained from this immunized horse during a period of 147 days following the last

injection of mallein. During this period the number of units per cubic centimeter of serum dropped from 100 to 7.

Dose of mallein for titrating an antiserum.—The amount of mallein used in the titration of our antiserum was always a fixed dose and equal to one-half of the maximum dose which with the antiserum caused complete fixation of complement and with a negative or normal serum did not cause any inhibition of hemolysis or deviation of complement. This one-half maximum dose of mallein assures the necessary excess or margin of antigen and at the same time eliminates nonspecific inhibitory action.

Dose of antiserum for titrating a mallein.—After titrating the antimallein serum and arriving at a unit, our next step was to discover the most suitable number of antiserum units to employ for determining the antigenic unit of mallein. In this work, a serum titrating at 0.01 c.c. was used, in two units (0.02 c.c. of serum), five units (0.05 c.c. of serum), ten units (0.1 c.c. of serum) and twenty-five units (2.5 c.c. of serum). As antigen our own subcutaneous mallein, in dilutions of from 1:100 to 1:600, was employed. The best gradation resulted in the row employing ten units of antiserum. The row in which five units were used is not quite so good, while that with two units gave only a three plus reaction in the first tube. On the other hand the row using twenty-five units, although no inhibition was evident in the serum control tube, has no advantage over the five-unit row.

We have not made enough observations on this point to lay down definitely a hard and fast rule for the number of antiserum units that must always be used in the titration of the antigen unit, since it could not be applied to an antiserum of low titer, for instance, one titrating out at 0.08 c.c., as it is obvious that ten units of such a serum would be far in excess, by volume, of the amount that could safely be used without causing inhibition. However, as an antiserum of high titer can be obtained without much difficulty, ten units should never amount to more than 0.2 c.c. by volume of antiserum.

To repeat and to make clear our system of titration for determining the reactivity of an antiserum and an antigen and for computing the number (N) of units in a given volume (V) of either reagent, the minimum amount (M) of the one which, in the presence of an excess but noninhibitory amount of the

TABLE 2.—COMPARATIVE REACTIONS OF DIFFERENT MALLEINS (ANTIGENS) WITH ANTIMALLEIN HORSE SERUM

Dose of antigen (mallein)	Mallein samples (as prepared for subcutaneous injection)							Ophthalmic mallein discs	
	A	B	C	D	E	F	G	X	Y	Z
cc.										
0.02 (1.0 of 1:50)	+	+	+	+	+		+	+	+	+
0.01 (1.0 of 1:100)	+	+	+	+	+		+	+	+	+
0.0066 (1.0 of 1:150)	+	+	+		+		+	+		+
0.005 (1.0 of 1:200)	+	+	+		+		+	+		+
0.004 (1.0 of 1:250)	+	+	+		+		+	+		+
0.0033 (1.0 of 1:300)	+	+	+		+		+	+		+
0.0028 (1.0 of 1:350)	+	+	+		+		+	+		+
0.0025 (1.0 of 1:400)	+	+	+		+		+	+		+
0.0022 (1.0 of 1:450)	+	+	+		+		+	+		+
0.002 (1.0 of 1:500)	+	+	+		+		+	+		+

[1] In all of these titrations the antiserum was employed in a fixed dose of 0.1 c.c., representing 10 units of antiserum (titer 0.01).

other, will fix one unit of complement is said to be a single, active unit. The amount of a given volume of reagent divided by the amount represented in a single unit will give the total number of units ($\frac{V}{M} = N$).

Ex.: The diagnostic dose of a certain mallein is given as 2.5 c.c. The antigenic unit of this mallein is determined as 0.0033 c.c.

$$\frac{\text{V (diagnostic dose) } 2.5}{\text{M (antigenic unit) } 0.0033} = 757$$

units in one diagnostic dose.

THE REACTIVITY OF DIFFERENT MALLEINS AS REPRESENTED IN UNITS OF ANTIGENS

Determinations of the units of antigen in a diagnostic dose of mallein have been made with seven samples of liquid mallein and with three samples of ophthalmic mallein discs. Two of the former, designated A and B, were products of our Biological Laboratory. The remainder, C, D, E, F, G, X, Y, Z, were all of different origin and obtained from foreign houses. Mallein A was used for the production of our antimallein serum.

The reactions are detailed in Table 2 and the determinations summarized in Table 3.

It may be noted that sample E, a foreign mallein, reacts more strongly than our own product A. This fact should eliminate a possible suspicion

TABLE 3.—SUMMARY OF COMPARISON OF MALLEINS

Sample[1]	One unit	Diagnostic dose recommended by the makers	Total number of units (approximate)
Liquid mallein A (our own)	0.0033	2.5 c.c.	750
Liquid mallein B (our own)	0.002	2.5 c.c.	1,250
Liquid mallein C (foreign)	0.0066	4.0 c.c.	600
Liquid mallein D (foreign)	0.01	2.0 c.c.	200
Liquid mallein E (foreign)	0.002	2.5 c.c.	1,250
Liquid mallein F (foreign)	nil.	1.0 c.c.	nil[2]
Liquid mallein G (foreign)	0.002	1.0 c.c.	500
Ophthalmic mallein X (foreign)	0.005	one disc	200
Ophthalmic mallein Y (foreign)	0.02	Do.	50
Ophthalmic mallein Z (foreign)	0.002	Do.	500

[1] Samples C and X are made by one maker, D and Y by another, and G and Z by a third.
[2] Apparently quite inactive.

that the antimallein serum used is more specific for our own mallein than for foreign malleins.

We have not checked the determinations shown in Table 3 with diagnostic tests on glandered horses, and therefore have not fixed a standard number of units for a diagnostic dose. It is plain, however, that samples D and Y fall far below what may be considered an average standard, while sample F appears to be quite inert.

Frozen mallein.—Mallein will readily freeze when exposed to severe cold, a contingency not unlikely during winter transit or storage. We have studied the effect of freezing in regard to antigenic value. A 10 c.c. bottle of our own mallein was well shaken and half its contents transferred to another bottle. This was put out of doors and frozen for thirty-six hours, during which time it thawed once, owing to a rise in temperature. Just before use the frozen sample was thawed at room temperature, mixed in dilutions and titrated. Comparing the results with the unfrozen sample titrated at the same time with identical reagents, no difference could be detected in the final results. One may therefore conclude that freezing has no effect on the antigenic value of mallein.

The foregoing experiments show that there is a marked antigenic variation in different samples of manufactured malleins. The number of units of antigen in each prescribed diagnostic dose of these different makes varies between 1,250 and zero.

Methods of titration, differing in the procedure followed by us but based on the same principles of the complement-fixation test, may give different results in respect to the total number of antigen units in a given volume of mallein, but the ratio would not be changed.

Working on similar lines in respect to the reactivity of tuberculins and certain vaccines, and without going into the details which will be given in subsequent papers of this series, we have found significant ranges of antigenic variations. Assuming that the efficacy of a biological product as a diagnostic, therapeutic or prophylactic agent is dependent upon and related to its antigenic value, we believe that the standardization of such products by complement fixation methods will give an assurance as to potency and dosage which at present is lacking or unwarranted. It would then be possible to substitute for the present crude system of dosage by volume or weight of products of varying and certain strength the more intelligent system of dosage by units of antigen.

SUMMARY AND CONCLUSIONS

The criteria commonly adopted for denoting the strength and activity of many biological preparations, so widely exploited for the diagnosis, treatment and prevention of animal diseases, are, for the most part, crude and unsatisfactory, and in some cases worthless.

The strength and activity of malleins, tuberculins, sera and vaccines or bacterins can best be expressed in terms of units of antigen and units of antibody.

The horse is easily sensitized to mallein and will furnish an antimallein or sensitizing serum of high titer. The immunity is not lasting and begins to fall, as shown by a gradual diminution in the number of antibody units, in about thirty days after the last injection of mallein. The immunity can be restored by further injections of mallein.

Rabbits have been found unsuitable for the production of a specific antiserum for complement-fixation tests in which a rabbit-antisheep hemolytic system is employed; that is to say, the antiserum (test serum) and the hemolytic serum should not both be obtained from the same species of animal.

Antimallein horse serum binds or deviates complement in the presence of mallein. It gives no reaction with tuberculin, blackleg filtrate, glycerin-bouillon and other culture media. The reaction is therefore specific for mallein.

The antigenic value of mallein can be ascertained by titrating the product with a predetermined, fixed dose of antimallein serum in complement-fixation tests.

The reactivity of malleins of different origin and manufacture show a wide and significant range of variation.

Alternate freezing and thawing does not reduce the antigenic value or change the reactivity of mallein.

Complement fixation permits of a relatively true estimate of the antigenic properties of bacteria and of their specific products and offers a satisfactory method of standardization.

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The many friends and colleagues of Dr. J. G. Rutherford, C. M. G., Commissioner of the Canadian Railway Board, will be interested to learn that he has been recently advised of his election as "Membre Correspondant" of the "Société Centrale de Médecine Vétérinaire de France."

This election took place at the annual meeting of the Society on May 4, 1922.

Our English contemporary *The Veterinary Journal* has organized two interesting tours for veterinarians, one of seven days to Belgium, including the fine Government Veterinary School and the battlefields, at a cost of about $45, and the other of three weeks to Italy, taking in the International Congress of Comparative Pathology at Rome in September, at a cost of about $180. If similar tours could be made from America at any such low rates it is safe to say that they would be largely patronized.

Dr. J. A. Allen addressed a meeting of the local branch of the same association in Charlottetown, P. E. I., April 29, outlining the work and functions of the Fox Research Station of the Canadian Government.

ANTISERA, AGGRESSINS AND PROPHYLAXIS, WITH A NOTE ON ROUP IN BIRDS[1]

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IN VIEWING the political history of the world one is forcibly impressed with the fact that "history repeats itself," that after every violent advance there is a violent reaction. After the excesses of the French Revolution the people welcomed the iron-handed dictator Napoleon, and after the rule of the Puritans the English people flew back with joy to their kings. It is, then, but natural that medical history should also run to extremes. If we look back over the progress made in medical science we observe that there have come at intervals furors of hope for the "cure-all"—the high tide of popularity of this remedy or that method of treatment. Each in turn has enjoyed its high position for a short period and then has been forgotten or succeeded by some newer idea which gained the point of vantage on the stage.

With the discovery of the relationship of bacteria and protozoa to disease in the latter part of the nineteenth century there ensued an era of unprecedented advancement. As new microorganisms were identified, new curative sera or prophylactic methods were devised. Bacterin therapy, serum therapy and chemotherapy became the supreme methods where heroic measures were sought. With these therapeutic measures went hand in hand the antiseptics, disinfectants and sanitary measures for the control and eradication of disease. So popular did these specific methods become that many practitioners almost completely lost the art of drug therapy and in many cases forgot or discarded the usual sanitary precautions required in the control of infectious diseases.

For some time, however, a violent reaction has been developing. In certain cases normal horse serum has been substituted for immune sera, with seemingly as good results. There are many who believe now that no results are possible from the

[1] Presented at the annual meeting of the California State Veterinary Medical Association, Los Angeles, June 6, 1922.

use of tetanus antiserum in horses; others are becoming skeptical as to the sole relationship of the tubercle bacillus to this disease, while others have been trying to create new diseases when acid-fast organisms corresponding to this group have been found localized in parts not customarily infected. Still others have come to the conclusion that the bacillus of Bang is not the primary cause of abortion in cattle because little progress is being made toward the development of a specific curative product. Others have questioned the relationship of the group of streptococci and bipolar organisms to specific diseases since these organisms are apparently ubiquitous in nature and are quite generally found upon the healthy mucous membranes of the respiratory tract. So the list might be extended.

It is not my purpose to attempt to substantiate or refute these claims. I merely refer to them to demonstrate the strong reaction that is following the advance made by serum therapy—and the end is not yet; the reaction has not yet reached its crisis.

Just now the faulty diet, deficiency disease and malnutrition are in the foreground. Since the classic feeding experiments with polished rice and other deficient foodstuffs there have appeared those who believe a solution of all remaining problems in medicine to be here at hand.

No one, I dare say, will doubt that there are deficiency diseases of dietary origin, notably xerophthalmia, scurvy and beriberi. On the other hand, pellagra, rickets and several other diseases are not yet so proved. Bacterial infections probably play an important rôle. At any rate evidence is by no means completely in favor of the unbalanced nitrogenous diet or avitaminoses as having the importance formerly thought.

Much progress has been made in clearing certain moot points regarding deficiency diseases, but one should guard against too hasty or too optimistic conclusions. Only recently the United States Public Health service reported that efforts during the year to discover the unidentified food substance whose absence from the diet predisposes to pellagra have excluded two of the three known vitamins, and a note of warning is sounded against the popular tendency to extol vitamins as a cure-all.

During the last twenty years the subject of filterable viruses has been much discussed. Whenever a disease did not readily respond to the usual methods of investigation an easy way out

was always the filterable virus. We can now look back and enumerate several diseases so considered at one time but now known to be due to specific organisms. The food poisonings, intoxications, ptomains and forage poisonings are examples of infections due to organisms long known but overlooked because considered saprophytic.

I hope that I do not merit the appellation of "alarmist," but I do believe that the present trend and condition justify some serious thought. Undoubtedly the best balanced individual will prefer to be conservative, to fly neither from the one nor to the other extreme.

Bacterins, vaccines and antisera are still excellent tools in the hands of the experienced workman, but he must remember that these products have their limitations. But when rightly used at the right time and in conjunction with all other available means, such as proper sanitary precautions, good nursing and proper food, they serve an excellent purpose.

It is probably true that in the past too little thought has been given the subject of proper foods. In veterinary medicine as in human medicine the fallacy has been that it was assumed that any diet that contained protein and carbohydrates with a certain amount of fats and salts must of necessity be above criticism. Such a diet, however, may utterly fail to support satisfactory nutrition.

Proper amounts of the protective foods, the leafy vegetables and plants, together with milk and eggs, must be consumed, but with these must go the requisite proportion of proteins, minerals and energy foods. The proteins may be derived from grains or seeds, but should preferably come from several sources, in order that if one is lacking in any necessary amino acid this lack may be compensated for by some other protein containing the missing element. It seems logical, in the light of more recent investigations, to conclude that improper nutrition predisposes to infection, rather than that malnutrition itself is the sole factor involved in many so-called distinct disease entities.

This brings me to the consideration of a concrete example that I should like to present. Several years ago the writer published a memoir on "The Etiology of Roup in Birds,"[1] in which it

[1] Kans. State Agr. Col., Tech. Bul. 4. 1917.

was stated that the causative factor of this disease was apparently a bacterium belonging to the pasteurella group. The organism can always be recognized in cases of the disease in smears made directly from the lesions; it has been isolated and grown upon artificial media, and finally, the dicase has been reproduced with pure cultures and a high degree of protection has been demonstrated against the natural disease after immunization with pure cultures of this organism.

This disease has been the cause of a great deal of controversy. There is yet much confusion as to whether roup, as typically represented by the swollen eye and head, is merely another form or manifestation of chicken pox or whether these are separate and distinct diseases. This latter point is of minor importance, however, so far as the problem of roup is concerned. It seems not unlikely that they may be caused by different etiological factors, yet this may not be the case. The vital point in the present discussion of roup is its cause.

Numerous investigators have studied the disease and numerous causes have been brought forward. The causes run from a filterable virus to several species of bacteria, and more recently a disease indistinguishable from roup has been attributed to malnutrition. In fairness to all, the question as to primary etiology continues to be an open one, but the fact still remains that in all the different stages of this disease we find predominating a bipolar staining organism that culturally and biochemically corresponds exactly to the pasteurella group.

Assume for the sake of argument that the true primary cause is a filterable virus or malnutrition or some other unknown organism, and not this member of the pasteurella group. If we can control this pasteurellosis and can thus prevent the complications that this organism undoubtedly is responsible for, it must be conceded that we have accomplished a good deal. On the other hand, because this organism can not be distinguished from *Bacterium avisepticus* or the other members of the group does not argue against its specificity, but rather supports the contention that under certain circumstances these organisms may live a saprophytic existence or they may invade the animal body and become parasitic. We know that the aggressive forces of the bipolar organisms may easily be completely lost when grown upon artificial media, and it would therefore seem logical to believe that the converse might also

hold true. When the organisms have invaded the living body they may localize themselves and assume a half parasitic rôle, causing chronic conditions such as are described for roup, or they may become true parasites and cause the acute forms of septicemia.

The relationship of the pasteurella group to this disease is based largely on the fact that repeated injections of a killed suspension of the organism, isolated from the eye lesions, does confer a decided protective influence against the natural virus of roup. While some investigators have reported failure to secure appreciable immunity in animals after the use of the various hemorrhagic septicemia bacterins on the market, it must be remembered, in the disease roup and probably in other infectious diseases, that the balance between the aggressivity of the microorganisms and the resistance of the macroorganism is probably very nearly equal. In many cases probably this balance is so nearly equal that but slight assistance to the host under field conditions will suffice to tide it safely over a possible danger period.

As a result of more recent work done, the conclusion has been arrived at that curative or prophylactic methods in this disease, as in others, must depend upon the combined use of all measures at our disposal. These methods are:

1. Prophylactic vaccination.
2. Thorough disinfection of buildings and grounds.
3. Properly balanced ration containing digestible proteins, energy foods and protective nutrients proportionately combined.
4. Isolation of infected animals, together with such treatment as the case indicates.

In conclusion I should like to emphasize that it is not the intention of the writer to underestimate the importance of the filterable virus, nutritional defects or other factors, but rather to call attention to the need of unbiased and impartial action in the treatment and control of disease.

At the recent commencement exercises at Central High School, Washington, D. C., each of the following veterinarians had a son or daughter among the graduates: D. E. Buckingham, H. K. Walter, W. F. Davis. and J. R. Mohler.

NORMAL TEMPERATURE OF THE ADULT DOMESTIC FOWL

By B. F. KAUPP

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HISTORICAL REVIEW

THE SUBJECT of the temperature of the domestic fowl in health is of undeniable importance, especially just at the present time on account of the attention paid to it by poultry specialists and veterinarians in the diagnosis of certain diseases of fowls. Observers have not put on record very many or lengthy articles on this subject. There is a gap in poultry literature upon this particular point, and it is with the desire to fill a small portion of this gap that the observations are given below.

Temperatures of the fowl are taken by inserting the thermometer in the cloaca. The normal temperature of the fowl is given by Colon (1)[1] as 108° F., while R. Mead Smith (2) and Wesley Mills give it as 107.6° F. Major Frederick Hobday (3) gave an average of 106.9° F., and a fair range to take when considering fowls at roost and at liberty appears to be between 105.5 and 108.5° F. The temperatures of 12 fowls, which had been at rest one hour, registered an average of 106° F., the temperature of the fowl-house being 39° F. The highest temperature was 107, the lowest 105.1. The temperatures of 18 fowls taken immediately after going to roost registered an average of 106.5° F.; the highest was 107.1, the lowest 105.6. The temperature of 26 fowls taken an hour and a half after going to roost averaged 106.8; the highest was 108.5, the lowest 105.6. The temperatures of 20 fowls taken an hour and a half after going to roost averaged 106.8, the highest being 108.5, the lowest 105.6. The temperatures of 16 fowls taken after having been at rest four or five hours gave an average of 106, the highest being 107.1 and the lowest 105. The fowl-house was 70° F. The average temperature of six fowls taken while at liberty, somewhat troublesome to catch, was 107.8, the highest

[1] Numerals after authors' names refer to list of literature at end of paper.

temperature being 109.2 and the lowest 107.8. The average temperature of 13 fowls taken while at liberty was 108.2, the highest temperature being 109.4, the lowest 107.2.

The average temperature of the duck is given by Cohn at 107.8° F. The average temperature of 24 ducks, taken when fastened up at night and also when at liberty, averaged 107.8; the highest was 109.4, the lowest 106.6. One very excited bird registered 111. The duck appears to have a temperature slightly higher than that of the fowl.

Major Hobday recognizes the fact that the temperature of the external atmosphere certainly plays some part. In hot, close weather the body temperature is slightly higher than in cold weather, and the rise caused by exercise is much more marked.

The writer (4) in 1917 made a summary of the temperatures of 48 fowls. The average temperature was 106.6° F. The breeds of fowls included Barred Plymouth Rock hens 2½ years old; Columbian and Golden Wyandotte hens 2½ years old; Single Comb Rhode Island Red pullets 8 months old; Single Comb White Leghorn hens 1½ years old, pullets 8 months old, and one cock 1½ years old; White Faced Black Spanish hens 2½ years old; Silver Campine cockerel 8 months old; Mottled Houdan hen 2½ years old, and a Buff Orpington hen 2½ years old; thus taking in both males and females, young and old, and different breeds.

In later work (5) it was observed that the temperature of the fowl was markedly influenced by the surrounding atmospheric temperature. During the year extending from November, 1918, to October, 1919, inclusive, the temperatures of 46 Single Comb White Leghorn hens were taken on the first day of each month with the following results:

TABLE 1.—TEMPERATURES OF BIRDS AS AFFECTED BY THE ATMOSPHERIC TEMPERATURE DURING THE YEAR.

Month	Year	Hour of taking	Atmospheric temperature	Average temperature of 46 Leghorn hens
			° F.	° F.
November	1918	11 a.m.	57	108.2
December	1918	11 a.m.	47	107.6
January	1919	11 a.m.	67	107.7
February	1919	11 a.m.	49	107.6
March	1919	11 a.m.	64	107.9
April	1919	11 a.m.	49	107.1
May	1919	11 a.m.	67	107.5
June	1919	11 a.m.	94	109.2
July	1919	11 a.m.	82	108.1
August	1919	11 a.m.	88	108.1
September	1919	11 a.m.	77	107.8
October	1919	11 a.m.	86	108.0

From this summary table the average temperature for 46 Single Comb White Leghorn hens, taken between the hours of 11 a. m. and 12 m. the first day of each month, was 107.7. It is further seen that the mass effect of temperature fluctuates to some degree with the atmospheric temperature surrounding the hen at the time of taking the temperature. On the days on which the atmospheric temperature ranged from 47 to 49, the average temperatures of the hens were from 107.1 to 107.6. On the days when the atmospheric temperature ranged from 57 to 77 the temperatures of the hens ranged from 107.5 to 108.2, and on the days when the atmospheric temperature ranged from 82 to 94 the lowest temperature of the hens averaged from 107.2 to 109.2. The range of temperature and average temperatures are tabulated in Table 2.

TABLE 2.—AVERAGE TEMPERATURES OF FORTY-SIX SINGLE COMB WHITE LEGHORN HENS IN DIFFERENT ATMOSPHERIC TEMPERATURES.

Range of atmospheric temperature	Range of temperatures of hens	Average temperatures
° F.	° F.	° F.
47–49	107.1–107.6	107.3
57–77	107.5–108.2	107.8
82–94	107.2–109.2	108.2

In a study of Table 1 it is of interest to note that on June 1 the atmospheric temperature was 94° F. The temperatures of the hens were taken between 11 a. m. and 12 m. One had a temperature of 110.4, another 110.0, another 110.5, and still another 110. The first of these in January carried a temperature of 107, the second 106.6, the third 108.0, and the last 107.1. The lowest temperature on June 1 was 108.

Some of these hens bearing the extreme temperatures June 1 laid that day and from appearance and former and past history were in perfect health. From this we gain the lesson that should we find the temperature of a fowl on a hot day as high as 110.5°, or 4.5 degrees above 107, which is usually accepted as normal, we would not be justified in saying that she had a fever or abnormal temperature due to disease; so that the temperature taking in birds is certain not to be of so great importance as in man or possibly mammals.

Kaupp and Herner (6) of the North Carolina Experiment Station and Manitoba Agricultural College, respectively, in a cooperative experiment determined the temperatures of Single

Comb White Leghorn hens. The hens were all reared at the Manitoba Agricultural College at Winnipeg, Canada. Twenty-five of the hens were kept at Winnipeg and twenty-five at Raleigh, N. C., a difference of 35 degrees latitude. Table 3 gives a summary of the monthly temperatures of the hens kept at Raleigh during the year extending from November, 1919, to October, 1920, inclusive. The weather temperatures here did not go quite so high as in the preceding report. However, one of the hens in June registered a temperature of 110.8, the only one that reached this point during these tests. It is interesting to note that on the days when the atmospheric temperature was between 73 and 80, the temperature of the hens, as an average, was 108 or above. All other temperatures were below 108, except on one day when the atmospheric temperature was 71 and the average temperature of the hens was 107.9. The lowest temperature as a monthly average was 107 and the highest was 108.7. The average of all months and of all hens was 108.

TABLE 3.—AVERAGE TEMPERATURES OF TWENTY-FIVE SINGLE COMB WHITE LEGHORN HENS AND ATMOSPHERIC TEMPERATURE.
(Temperatures taken first day of each month at Raleigh, N. C.)

Month	Year	Average temperature of hens	Atmospheric temperature
		° F.	° F.
November	1919	108.5	81
December	1919	107.5	51
January	1920	107.8	67
February	1920	107.8	29
March	1920	107.9	42
April	1920	107.9	71
May	1920	108.0	72
June	1920	108.7	84
July	1920	108.3	85
August	1920	108.3	86
September	1920	108.3	86
October	1920	107.0	63

The temperatures were taken, on the first day of each month, of the twenty-five Single Comb White Leghorn hens kept at Winnipeg. This was done under the supervision of Prof. M. C. Herner. Table 4 gives a monthly summary of these temperatures. The average temperature for the twelve months is 107.4. We do not find here the fluctuations from month to month that are observed in the other studies.

The average temperatures of fowls as recorded by different authors here cited are given in Table 5. The average for all authors and tests to date is 107.4. The average for the present author's three studies to this point is 107.4.

TABLE 4.—AVERAGE TEMPERATURES OF TWENTY-FIVE SINGLE COMB WHITE LEGHORN HENS AND ATMOSPHERIC TEMPERATURE.
(Temperatures taken the first day of each month at Winnipeg, Canada.)

Month	Year	Average temperature	Atmospheric temperature
		° F.	° F.
November	1919	108.6	18
December	1919	108.2	−16
January	1920	107.9	− 6
February	1920	108.2	18
March	1920	107.8	30
April	1920	107.3	38
May	1920	107.3	62
June	1920	107.4	62
July	1920	107.7	82
August	1920	106.9	72
September	1920	107.4	67
October	1920	107.1	63

TABLE 5.—AVERAGE TEMPERATURES OF FOWLS AS RECORDED BY DIFFERENT AUTHORS.

Author	Temperature determination
	° F.
Colon	108.0
Smith and Mills	107.6
Hobday	106.9
Kaupp (1917 investigations)	106.6
Kaupp (1918–19 investigations)	107.7
Kaupp (1919–20 investigations)	108.0
Herner	107.4

THE PROBLEM

The determination of the normal temperature of the fowl is of importance. In the clinical study of disease of fowls a knowledge of the normal temperature aids in determining whether or not the fowl has an elevation of temperature or fever.

Our problem consisted in determining the cloacal temperature of different groups and different breeds of hens at different periods of the twenty-four hours, to study further the influence of atmospheric temperature on the temperature of the body and to determine at what time in the twenty-four hours the body temperature is normal, that is, at what hour all surplus body heat accumulating during the day is gotten rid of.

EXPERIMENTAL METHODS

The temperatures were taken with a human size, one-minute, clinical thermometer. After shaking down the mercury below 100 degrees, the thermometer was inserted into the cloaca and allowed to remain for two minutes. The temperatures were taken at 5 p. m., 12 midnight, 5 a. m., and 12 noon. Care was taken not to excite or greatly exercise the hens, as such excitement we observed caused a rise of temperature in two or three

minutes. The breeds selected were Single Comb White Leghorns, Single Comb Rhode Island Reds and Barred Plymouth Rocks. The temperatures are studied in two groups, namely, males and females.

EXPERIMENTAL DATA

The results are given in Tables 6 to 8 and are summarized in Table 9.

TABLE 6.—TEMPERATURES OF SINGLE COMB WHITE LEGHORNS AT DIFFERENT HOURS THROUGHOUT THE TWENTY-FOUR.

(Commenced February 20, 1922; completed February 21, 1922.)

Sex and No.	5 p. m.	12 midnight	5 a.m.	12 noon
Females:				
184	107.6	104.7	106.7	107
177	107.6	105.1	106.6	107
190	107.8	105.5	106.2	106
181	107.4	103.3	104.5	106.7
189	107	105	106.6	106.3
218	107.5	105.6	106.7	106.8
197	106.4	106.4	107.7	107.1
179	107.8	105.9	106.4	107
194	107.3	105.9	107.2	107.6
203	107	105.4	107.3	107.2
Average	107.5	105.2	106.5	106.8
Males:				
215	107.6	106.8	107.4	107.7
58	106.2	104.8	107.3	107.8
957	107.6	105.6	105.7	108.7[1]
214	107	104.4	108.3	107.7
Average	107.1	105.3	107.1	107.9
Atmospheric temperature	72	59	54	57

[1] This bird was wild and struggled.

TABLE 7.—TEMPERATURES OF SINGLE COMB RHODE ISLAND REDS AT DIFFERENT HOURS THROUGHOUT THE TWENTY-FOUR.

(Commenced February 25, 1922; completed February 26, 1922.)

Sex and No.	5 p.m.	12 midnight	5 a.m.	12 noon
Females:				
422	107.7	104.2	105.5	106.1
461	107.2	103.5	104.5	106.1
495	107	104.3	104.4	106.4
441	106.8	105.2	105.5	105.9
421	106.8	104.2	105.1	106.6
468	106.8	104.3	105	106.6
410	106.7	104.6	105.4	106.2
415	106.7	104.6	105.4	106.5
426	107	104.6	105.9	107.1
442	106.2	104.1	104.7	105.9
Average	106.8	104.3	105.1	106.3
Males:				
Blue band				
Green band	106.7	103.6	105.7	105.2
Green band	107.2	103.5	105.3	105.2
Green band	106.8	104.3	105.2	105.8
Average	106.9	103.8	105.4	105.4
Atmospheric temperature	56	51	47	45

Observations: The Rhode Island Reds are much more easily handled than the White Leghorns.

TABLE 8.—TEMPERATURES OF BARRED PLYMOUTH ROCKS AT DIFFERENT HOURS THROUGHOUT THE TWENTY-FOUR.

(Commenced February 27, 1922; completed February 28, 1922. Maximum atmospheric temperature February 27 was 70° F. and minimum 44, with a mean of 57. Maximum temperature February 28 was 60, minimum 46, average 53.)

Sex and No.	5 p.m.	12 midnight	5 a.m.	12 noon
Females:				
972	106	105.4	106.2	106.9
958	106.3	104.8	105.1	106.4
975	106.5	104.9	105.7	106.3
984	107.4	105.1	105.3	106.3
805	105.5	104	105.4	105.5
963	107.2	104.4	105	107.4
990	106	104.8	104	107.2
976	106.4	105	105.2	106.7
962	106	104.3	104.3	106.2
973	106	104	104.3	106.2
Average	1 6.3	104.6	105	106.5
Males:				
1	107.7	104.5	105.1	107
2	107.5	104.9	105.4	107.1
3	107.3	104	105.1	106.9
4	107.5	104.4	105.8	106.3
Average	107.5	104.4	105.3	106.5

Observations: The cocks are more excitable than the hens.

TABLE 9.—SUMMARY OF TEMPERATURES OF FOWLS TAKEN AT DIFFERENT PERIODS OF THE TWENTY-FOUR HOURS.

Breed	Sex	5 p.m.	12 midnight	5 a.m.	12 noon
S. C. White Leghorns	Hens	107.5	105.2	106.5	106.8
S. C. Rhode Island Reds	Hens	106.8	104.3	105.1	106.3
Barred Plymouth Rocks	Hens	106.3	104.6	105.0	106.5
Average	Hens	106.8	104.5	105.5	106.5
S. C. White Leghorns	Cocks	107.1	105.3	107.1	107.9
S. C. Rhode Island Reds	Cocks	106.9	103.8	105.4	105.4
Barred Plymouth Rocks	Cocks	107.5	104.4	105.3	106.8
Average	Cocks	107.1	104.5	105.9	106.7
Average of both sexes		106.9	104.5	105.7	106.6

DISCUSSION

The cloacal temperatures of three lots of adult fowls are here summarized. There is apparently no difference between the temperatures of the males and females.

The temperatures of these fowls were highest at night, gradually becoming lower after the fowl goes to perch till at midnight all surplus heat from the body is apparently eliminated and the average fell to 104.5° F. Nearing dawn the birds become restless and soon begin to move about, which causes surplus heat to accumulate in the body. At this time the average temperature was 105.7. From this time till noon the temperature gradually rose to 106.6 and by 5 p. m. had reached 106.9. These temperatures were taken during the month of February,

hence the fowls were not subjected to high atmospheric temperatures and as a result the temperatures are slightly lower than some given in the historical review where at the time of taking the temperatures hot noon-day weather prevailed. The average of the daylight temperatures was approximately 106.8, or 0.6 degree below the average of all authors quoted in the historical review.

From all studies recorded it would appear that 107.3° F. is an annual approximate temperature, while this is likely to be slightly more during warmer and less during the colder weather.

LATER TEMPERATURES OF SAME FLOCKS

The temperatures of the Single Comb White Leghorns recorded in Table 6 were taken February 20 and 21, and temperatures of the same flocks were again taken May 25 and 26. On this latter date the atmospheric temperature was higher, and it was the desire to determine if the average temperature of the flock would be higher in keeping with the increased atmospheric temperature. Temperatures were also taken at this time of the birds of the flock recorded in Table 7. These later temperatures are given in Tables 10 and 11. Table 12 gives the comparative results of the temperature readings for the two periods.

TABLE 10.—TEMPERATURES OF SINGLE COMB WHITE LEGHORNS AT DIFFERENT HOURS THROUGHOUT THE TWENTY-FOUR.

(Commenced May 25, 1922; completed May 26, 1922. Same flock as in Table 6.)

No.	5 p.m.	12 midnight	5 a.m.	12 noon
Hen 218	106.5	104.9	105	107
197	107.2	104.9	106.3	103.2
194	107.3	104.8	105.8	107
203	106.9	105.1	105.6	107.3
184	107.4	105.1	106	106.4
190	107	105	105.2	106.2
177	107.1	105.1	106	106.4
181	106.8	104.7	106	106.4
189	107.5	104.3	105.3	106.4
179	107.4	105.6	105.6	107.1
Average	107.1	104.9	105.6	106.3
Cock 215	108.2	105.4	106.3	107.5
Atmospheric temperature	79	70	65	83

The temperatures taken in May do not disturb the former figures and do not indicate that in 1922 the difference between the atmospheric temperatures of February and May was sufficient to cause a perceptible rise in body temperature of the flock as a whole. Other records have shown, however, that when

the atmospheric temperature rises above 70° F. there is likely to be quite an excess temperature stored up in the body and a rise above the average.

TABLE 11.—TEMPERATURES OF SINGLE COMB RHODE ISLAND REDS AT DIFFERENT HOURS THROUGHOUT THE TWENTY-FOUR.

(Commenced May 24, 1922; completed May 25, 1922. Same flock as in Table 7.)

No.	5 p.m.	12 midnight	5 a.m.	12 noon
421	107.2	105.1	106.3	106.2
461	106	104.2	105.1	105.9
442	107	105.7	106.2	107.4
410	106.4	104.5	106.2	106.3
468	107.6	106	107.4	106.3
495	106.4	104.6	106.6	105.9
426	107	105.2	107.2	106.2
422	107.9	105.2	106.4	106.6
415	105	104.2	105.5	107.1
441	106.6	104.9	105.7	106
Average	106.7	105	106.2	106.3
Cock B	107.4	104.8	106.8	106.5
Cock G. L. B	107.4	104.8	105.6	106.3
B-G Cock	107.3	104	105.1	106
Average	107.4	104.5	105.8	106.2
Atmospheric temperature	82	64	62	82

TABLE 12.—COMPARATIVE RESULTS OF TEMPERATURES OF SINGLE COMB WHITE LEGHORN AND SINGLE COMB RHODE ISLAND RED MALES AND FEMALES TAKEN IN FEBRUARY AND MAY, 1922.

Breed	Sex	Month	5 p.m.	12 midnight	5 a.m.	12 noon
S. C. White Leghorn	Hens	Feb.	107.5	105.2	106.5	106.8
S. C. White Leghorn	Hens	May	107.1	104.9	105.6	106.3
Atmospheric Temperature		Feb.	72	59	54	57
Atmospheric Temperature		May	79	70	65	83
S. C. R. I. Red	Hens	Feb.	106.8	104.3	105.1	106.3
S. C. R. I. Red	Hens	May	106.7	105.0	106.2	106.3
Atmospheric Temperature		Feb.	56	51	47	45
Atmospheric Temperature		May	82	64	62	82
S. C. W. Leghorn	Cocks[1]	Feb.	107.1	105.3	107.1	107.9
S. C. W. Leghorn	Cocks[1]	May	108.2	105.4	106.3	107.5
S. C. R. I. Red	Cocks[1]	Feb.	106.9	103.8	105.4	105.4
S. C. R. I. Red	Cocks[1]	May	107.4	104.5	105.8	106.2
Average of both sexes and breeds:		Feb.	106.9	104.5	105.7	106.6
		May	107.0	104.9	105.9	106.4

[1] Atmospheric temperature same as for hens.

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THE PROTECTION OF LAMBS FROM STOMACH WORMS

By COOPER CURTICE

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IN EXTENSIVE TESTS which have been carried on during the past eight years at the Bureau of Animal Industry farm near Vienna, Virginia, the use of bluestone solution is the only satisfactory means of controlling stomach worms under practical conditions that has been discovered. By its systematic use throughout the year stomach-worm infection has been easily, economically and effectually kept under control. Directions for the preparation and use of the remedy follow.

THE BLUESTONE REMEDY

The Stock Solution

A stock solution is prepared as follows:

Coarsely powdered bluestone (copper sulphate)	1 pound
Boiling water	2 quarts

Add the bluestone to the water and dissolve it completely. Replace any water that evaporates to make a total of 2 quarts. Store in glass or stoneware, tightly stoppered. This will keep indefinitely and when diluted for use is sufficient for 400 doses. *This is a stock solution and must not be administered in this strength, for it will kill sheep.* It must not be allowed to lose water by evaporation.

Dilution for Use

For use 3 quarts of water is added to 4 fluid ounces of the stock solution for each 25 head of sheep to be dosed.

Apparatus

The apparatus needed consists of one four-ounce glass graduate, one graniteware quart measure, one graniteware gallon measure and one drenching tube. A baby's graduated nursing bottle may be used instead of the graduate and tube, but it is not so convenient and it takes more time. The drenching tube consists of three pieces fitted together in this order: A hard or flexible rubber or graniteware funnel, a 3½-foot rubber

tube and a 6-inch brass tube. The caliber of the rubber tube is three-eighths of an inch; the brass tube and the funnel fit into it. The outside diameter of the rubber tube is five-eighths of an inch. A thinner tube has proved less convenient to handle and less durable.

The Dose

The bluestone is used only after dilution by the addition of water to the stock solution. Four fluid ounces of the diluted solution is given to each sheep weighing 80 pounds or over. The weight of the sheep may be estimated, but the doses are measured accurately, not guessed at. For a lamb of 60 pounds a dose of 3 fluid ounces and for a lamb of 70 pounds 3½ fluid ounces is used.

It has been found unnecessary to take the sheep from the pasture until a short time before dosing. A convenient small pen is prepared either within or next to a large one, so arranged that a few sheep may be driven in quickly and individual sheep released outside after dosing.

Dosing the Sheep

Two persons are necessary to give the dose. One straddles the sheep, holds its muzzle with one hand and inserts the tube four inches into its mouth with the other. The other measures the dose, holds the drenching tube and pours the dose into the funnel. Backing the sheep into a corner helps to steady it. The sheep should remain standing with its head nearly horizontal, and care should be taken not to choke or strangle it. Plenty of time should be allowed for it to swallow. Moving the tube in the mouth often aids in getting the sheep to swallow. More than 50 sheep may be dosed in an hour by experienced operators, but *carelessness and haste are dangerous and must be avoided.* The dosing should preferably be done under competent veterinary supervision . In any case it should not be entrusted to inexperienced or naturally careless persons.

Time of Dosing

All sheep on the farm except young lambs are dosed regularly every four weeks throughout the year, but pregnant ewes are not dosed within two weeks of lambing. The dosing of the ewes is renewed at the next regular dosing date after lambing. If for any reason it has been necessary to change the date of dos-

ing, a slightly earlier day has been chosen rather than a later one. Sheep occasionally have been dosed one week after a previous dosing without apparent harm. Under such circumstances the next dose follows in four weeks. During the growing pasture season three-week intervals between doses are better than four-week intervals. The regular dosing of lambs is begun as soon as they are weaned.

SUPPLEMENTARY CONTROL MEASURES

Medicinal treatment of the flock, though it has greatly reduced losses from stomach worms, even when the same pasture land is used continuously, has given much better results when supplemented by frequent changes to clean or only slightly contaminated pastures. At the Vienna farm it has been found that yearlings and older sheep under systematic bluestone treatment may be pastured almost anywhere with little or no damage by stomach worms. Younger lambs, however, may not altogether escape injury unless precautions are taken in addition to the medicinal treatment of the ewes. Young lambs have not become seriously affected with stomach worms while running with older sheep in barns and yards free from vegetation and from which the manure had been removed prior to lambing time.

The important precaution taken in addition to the periodical treatment of the ewes has been to provide for the lambs and ewes pasture that is free or almost free from worm infection. This has been accomplished by utilizing fields of planted crops such as rye, wheat, oats or barley, not occupied by sheep or cattle since the plowing of the fields. Creeps or hurdles to enable the lambs to graze ahead of the ewes and temporary divisions of fields have also been employed as expedients to provide clean grazing for the lambs.

Grass land may be used sparingly if there have been no sheep or cattle on it within a full year previously. Cultivation greatly reduces the infection of the soil, and much of the infection dies out on pasture land from which sheep or cattle have been excluded for at least a year.

By thus utilizing clean or only slightly infested fields, meanwhile not neglecting the monthly dosing of the ewes, and making sure that they are well fed to favor copious milk production, lambs born in February and March have been reared to

marketable age at the Vienna farm before the most dangerous part of the stomach-worm season, namely, the period from July to October in the latitude of Washington, D. C.

It is true that even with these precautions the lambs have sometimes picked up a few worms, but these have not been numerous enough to do serious immediate damage. Nevertheless, as a few worms carried by the lambs are likely to infect fields or pastures to which the lambs are moved after weaning, it has been assumed that lambs kept continuously on one field or pasture after weaning will scarcely escape further stomach-worm infection, even though the field or pasture is quite clean when the lambs are placed on it. The lambs, having brought with them a few worms that will produce eggs to contaminate the new pasture, pick up young worms resulting from this contamination, and these produce eggs to contaminate the pasture still further. Additional infection is then likely to be picked up by the lambs, leading to greater contamination of the pasture, and so on, in increasing progression, until the worms become so numerous in the lambs as to cause serious damage. Accordingly when weaned and separated from the ewes the lambs that were retained for breeding stock or for marketing later in the year were given occasional changes of pasture as before weaning, utilizing fields of stubble, rape, soy-beans, clover, grain, etc. As already noted, when the lambs were weaned they were started upon the routine of periodical treatment with bluestone solution.

The lambs have thus been doubly safeguarded. First, the use of clean or nearly clean pasture has reduced the chances of their picking up many worms, and second, the bluestone treatment has destroyed most of the worms that the lambs may have picked up from time to time, thus retarding and minimizing the contamination of the pasture.

On the Vienna farm during the systematic application of the bluestone treatment it has been found that special precautions as to pasture may be gradually relaxed in the late autumn and that the sheep may thereafter be pastured wherever convenient with little danger of damage from stomach worms.

ADVANTAGES OF THE BLUESTONE TREATMENT

Sheep regularly dosed with bluestone and otherwise properly cared for have weighed more, produced more wool, and

have been better milk producers than untreated sheep. Their lambs from birth have been healthier. Untroubled by worms and getting plenty of milk, the lambs have thrived and grown rapidly, reaching a marketable size at the age of three to five months. The yearling ewes saved for breeding purposes, having grown well as lambs, have continued their growth. They commonly have become larger ewes than their dams, in cases in which these latter were raised without precautions against worm infestation. At slight expense the bluestone treatment has greatly increased profits in the production of mutton, wool and breeding stock.

SUMMARY OF METHOD OF PREVENTING STOMACH-WORM LOSSES

All sheep on the farm are dosed with bluestone solution every four weeks throughout the year, except unweaned lambs and pregnant ewes within two weeks of lambing.

Manure is removed from barns and yards before lambing.

The unweaned lambs and the ewes to which they belong are kept on forage fields and pastures that are as free as possible from previous contamination by sheep and cattle, and the flock of ewes and lambs is changed to fresh fields as frequently as possible. Creeps or hurdles, allowing the lambs to graze ahead of the ewes, have been found useful.

Treating the lambs with bluestone is begun at weaning time, and they are then kept on fields and pastures that are as clean as possible, changing frequently to fresh ground. They are, however, excluded from fields and pastures that are to be used for handling the next lamb crop, unless the land is to be plowed up and planted before it is used again.

VIRULENCE OF BLOOD OF AN APPARENTLY RECOVERED CASE OF SWAMP FEVER

The following interesting case report has been recorded by the office of the Veterinary Director General of Canada: A heavy gelding now about 20 years old first showed swamp fever infection in 1911. For the last eight years no definite symptom of the disease has appeared and this horse had done some work. The blood of this gelding injected into a healthy horse in April, 1922, has produced swamp fever—over *ten years* since the infection occurred, and in spite of the apparently normal condition maintained.

A NEW METHOD FOR DETECTING THE EGGS OF PARASITES IN FECES

By THEODOR VAJDA

Professor of Pharmacology, Veterinary School, Budapest, Hungary

IN OVER A YEAR I have made well over 1,000 fecal examinations and found that in the feces of domestic animals *Coccidium, Ascaris, Strongylus, Oxyuris, Dochmius, Œsophagostomum, Trichuris* and *Dipylidium caninum* eggs can be detected easily and in great amount by the following method:

Dilute the feces with water and mix well with glycerin (sp. gr. 12.5) in a short test tube with a large opening or in a conical medicine bottle of 10 to 25 grams capacity. This mixture should be left standing for one-half to one hour, or centrifugalized and examined after being left standing for a certain time. The quantity of water to be mixed with the feces depends on their origin and constituency. A given amount of horse or hog feces of normal constituency should be mixed with twice this amount of water; a given amount of sheep, goat or dog feces with three times this amount of water. For soft feces the amount of water should be diminished, and in cases of diarrhea the feces must be examined without the addition of water.

I have found that there is a difference in the specific gravity of the eggs of the different parasites, therefore I have had to vary the quantity of glycerin according to the species of parasites involved. To isolate the maximum number of eggs I use one part of glycerin to get *Strongylus, Oxyuris, Dochmius* and *Œsophagostomum* eggs, and this amount also served in the case of *Coccidium,* 1½ parts for *Ascaris megalocephala* and 3 parts for *A. marginata, A. lumbricoides* and *Trichuris.* If more than the amount of glycerin stated here is used, the amount of eggs recovered is not materially diminished, but if less is used some eggs, for instance, those of ascarids, can not be detected at all.

From the surface of the feces prepared with glycerin, or from the liquid strained through linen, eggs can be detected after a few minutes. Their number increases considerably after standing ½ to 1 hour. If the preparation is centrifugalized at moderate speed for 15 to 20 minutes and allowed to stand a few minutes

one can obtain a great number of eggs by carefully removing them from the surface with a glass rod. (See illustration.) I found it very important to take great care in touching the surface of the centrifugalized feces-water mixture with a dry, clean glass rod, because if this rod is dipped into the liquid much fewer eggs are recovered. The same is true if a pipette is used.

Thousands of *Ascaris* eggs can be recovered when present if we mix and stir well a large quantity of horse or hog feces with double this amount of water and strain it through gauze, bringing the four corners of the gauze together and pressing out the liquid. After centrifugalizing at moderate speed for 30 minutes the liquid on top of the sediment can be poured out (keep about 1 to 2 c.c.), as it does not contain any eggs. The sediment should be mixed carefully with 1½ parts of glycerin for horse feces and 3 parts for hog feces by means of a glass rod, again centrifugalized for 15 to 20 minutes and left to settle for a short time. The milky white surface of the liquid, which is light brown, will contain a great amount of eggs if many ascarid eggs are present in the feces examined.

The eggs remain a long time unchanged on the surface of the feces thus prepared with glycerin, and the embryos in the eggs develop to a certain degree. In the eggs of *Ascaris marginata* moving embryos can be detected as early as the sixth day, and they are still motile after a month, because the glycerin does not penetrate into the inner part of the eggs. After standing 3 months a great number of deformed *Strongylus* eggs with granular protoplasm and even a greater number of *Ascaris megalocephala* eggs containing nearly unchanged and well-developed embryos were found.

All the eggs can be removed from the surface of the liquid by the following method: Fasten filter paper by means of a string at the mouth of a test tube and dip it into the large centrifugal tube which contains the feces-glycerin mixture, until the whole surface of the filter paper touches the surface of the liquid. The filter paper must be dried afterwards. *Ascaris* eggs can be taken for examination from such filter papers, kept in a well-closed glass, and after 8 months are easily discernible if kept for a short time in water containing glycerin. This method can be put into practice in cases where animals are suspected of having ascarids and there is no opportunity to make a microscopic examination on the spot. Instead of sending the

feces, which will rapidly decompose, to the laboratory, we send the filter paper treated as noted above.

Fluke eggs can not be isolated by this method. They are deformed and break up after a few minutes' exposure to the glycerin. I could not increase the resistance of the fluke eggs to the action of glycerin either by treating them with formalin or by boiling them. It would be very interesting to determine by experimentation whether the necessary amount of glycerin introduced into the alimentary canal has the same effect on the fluke eggs or not.

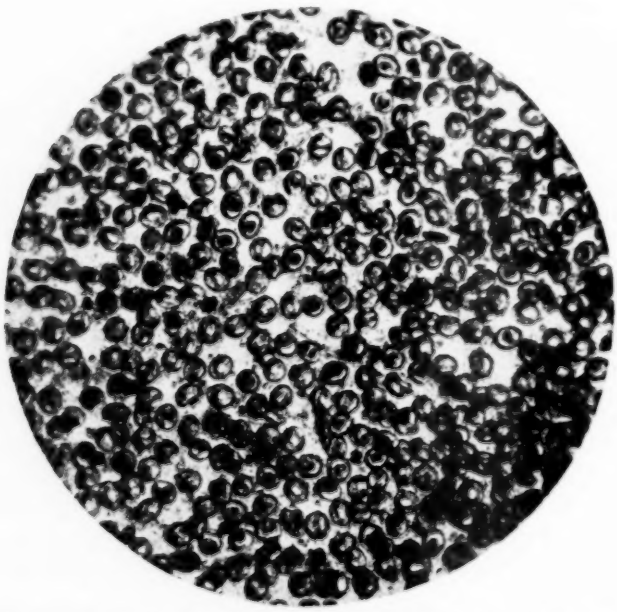
The advantages of the above-described method are the following:

1. A great number of eggs can be isolated even from a very small quantity of feces (½ gram). We counted 1,358 *Ascaris lumbricoides* eggs in one preparation and 1,130 in another.

2. The eggs become more transparent and their structure is more readily visible.

3. They keep their original form for a long period.

4. The liquid separated from the surface of the glycerin-feces mixture can be examined under the microscope without using a cover-glass and can be kept for several days without desiccating.



A small part of eggs of Ascaris Marginata isolated by the author's method from 10 grams of fresh dog feces.

FATALITIES IN CATTLE DUE TO THE TICK DERMACENTOR VENUSTUS [1]

By E. A. BRUCE

Animal Pathologist, Health of Animals Branch, Canadian Department of Agriculture, Agassiz, British Columbia

THE TICK *Dermacentor venustus* is found throughout the greater part of southeastern British Columbia, and in the early spring frequently causes paralysis and sometimes death in man and animals. The condition is exceedingly common among sheep, by no means uncommon in children, rare in adults, and comparatively rare in dogs. Although this is the commonest tick on cattle, with the exception of *D. albipictus,* no records have been made as to its causing trouble in such animals. It is therefore of interest to note that two fatal cases have recently come to our notice.

In sheep, man and the dog it is known, largely through the work of Hadwen, that paralysis and even death may be caused by a single tick. Only the females are incriminated and they are not liable to cause serious trouble unless feeding fast.

I am indebted to Mr. T. A. Moilliet of Vavenby (90 miles north of Kamloops) for information covering the two cases described below, and for specimens of the ticks, six gorged females and one male of *D. venustus* being received. Mr. Moilliet is an educated man, and has had some considerable experience with tick paralysis in sheep, the writer having visited his ranch in the spring of 1920, at which time he had had about 300 sheep affected out of a band of 400.

It is perhaps of interest to mention briefly this particular outbreak in sheep, as it gives an excellent idea as to how soon the condition may develop after exposure to ticks. Turned out on range April 5. First case, yearling ewe, on the 13th. Two cases on the 14th. On the 16th practically the whole band affected, yearlings worse than older sheep. On the 17th about 300 of the sheep were treated around the neck region with a 60 per cent creolin dip solution, the other 100 being treated as the necessity arose, and gorged female ticks being removed by hand. (This treatment is not recommended, as the solution is

[1] Published by permission of Dr. F. Torrance, Veterinary Director General of Canada.

hard on the hands and has apparently no effect on ticks that were already attached.) On the 18th some of the affected sheep were getting better and others worse. On the 19th improvement was marked. This continued, and on the 25th the sheep were moved from the hills to meadow land. On the 28th these sheep were seen by the writer. On going through the band a few showing slight symptoms of incoordination were seen, and one paralyzed case was found. This was a yearling upon which 10 females were found gorging, the majority being in the vicinity of the spinal column. After careful search all gorging females were removed (about noon), and toward night the sheep was eating, and while distinctly groggy was recovering nicely.

CASES IN CATTLE

Some affected cattle were imported from Alberta the preceding fall.

Symptoms are said to be the same in both sheep and cattle, the animals falling for no apparent reason, and when down manifesting a continual walking movement of the feet and no movement of the bowels.

Case No. 1.—Two-year-old heifer, pregnant, in poor condition. Found dead April 25. Had probably been dead two days, and judging from the hole it had dug with its feet had been down at least 24 hours before it died.

An area about an inch across was found just back of the horns at the base of the skull, that was covered with the excrement of ticks. There were four other places along the spine that showed where ticks had attached either singly or in small groups.

Case No. 2.—Two-year-old heifer, same age and condition as preceding case. When seen April 25 was alive and had been down probably 12 hours. Was offered water and drank a pail and a half. About six inches in front of the kidneys and close to the spine a large area about three inches in diameter was found that was covered with ticks. The majority of these were gorged females, but a number were only partially gorged, and several males were noticed to be moving around among the females. It is estimated that over a hundred ticks were on this area. There was also a much smaller area at the base of the skull, and several other places where ticks were attached singly. As the owner of these cattle lived some miles away, he was ad-

vised as to their condition. On my return in ten hours later the heifer was found to be dead.

Although these cattle were in poor condition, as is usual at this time of year, they were not so poor as to become weak, and food was plentiful, the bunch grass being four inches high. Neighboring cattle turned out a week earlier in a country where there was less feed but no ticks did well.

To sum up, ticks taken off the paralyzed heifer proved to be *Dermacentor venustus*. Knowing the dangerous character of this tick and the excellent reputation of the man who reported the condition, there seems to be no doubt whatever that death in the two cattle mentioned was due to *D. venustus*. The fact that the animals had been recently imported is another strong link in the chain of evidence, as they would not enjoy the same immunity as native stock.

REFERENCES TO LITERATURE

HADWEN, S. 1913. On "tick paralysis" in sheep and man following bites of *Dermacentor venustus*. Parasitology, vol. 6, No. 3.

HADWEN, S., and NUTTALL, G. H. F. 1913. Experimental "tick paralysis" in the dog. Parasitology, vol. 6, No. 3.

BRUCE, E. A. 1920. Tick paralysis in British Columbia. Bul. 28, Health of Animals Branch, Dept. of Agric., Ottawa.

A delegation consisting of Drs. McGilvray and Campbell, Toronto; Drs. Daubigny and Dauth, Montreal; Dr. Hollingsworth, Ottawa; Dr. Bradshaw, Manitoba, representing the Veterinary Associations of Ontario, Quebec and Manitoba, was received by the Honourable Mr. Motherwell, Minister of Agriculture. The Veterinary Director General and the Chief Animal Pathologist were in attendance.

The delegates presented an appeal for better facilities for laboratory work, veterinary research and cooperation to enable the veterinary profession of Canada to extend their efforts towards the welfare of the animal industries.

Dr. E. A. Bruce addressed a meeting of the local branch of the Canadian Technical Agriculturist Association in Vancouver, April 4, on problems in animal pathology of special importance to British Columbia. "Redwater" of cattle was mentioned as a problem in which cooperation between pathologists and soil experts was needed.

A FATAL DISEASE OF YOUNG PIGS APPARENTLY CAUSED BY THE BACILLUS OF SWINE ERYSIPELAS

By L. T. GILTNER

Pathological Division, Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

THE ANNOUNCEMENT in May, 1921, by Creech [1] that "diamond skin" disease of hogs is a manifestation of chronic swine erysipelas, and since then the report by A. R. Ward [2] of the isolation of *Bacillus erysipelatis suis* in certain cases of polyarthritis in swine, have given rise to much speculation as to whether or not the acute type of the disease exists in this country. Quite recently the writer encountered what he believes to be an essential bacteriemia in a three-week-old suckling pig in which *B. erysipelatis suis* was the invader.

ISOLATION AND STUDY OF THE ORGANISM

The pig died about 10 o'clock in the morning and was brought to the laboratory within less than four hours after death in very good condition for bacteriologic study. The heart's blood, lungs, liver, spleen and kidney were cultured at once in beef infusion broth, glycerin agar and serum agar. Examined after about 48 hours' incubation, all the solid media showed delicate growths suggestive of that of a streptococcus. The broth cultures were all faintly clouded. With the exception of a single colony of a contaminating organism in the culture from the heart's blood, all the cultures were pure. The organisms were found to be non-motile, Gram-positive, slender rods, straight or somewhat curved, and varying in length from 1 to 4 microns. They occurred singly, in pairs, or in short chains of a few elements, and often, in preparations from broth or solid medium cultures, they appeared as a tangled clump of organisms.

CULTURAL CHARACTERS

The growth on plain agar, glycerin agar or serum agar was essentially the same. In 24 hours there appeared small, round,

[1] G. T. Creech. The bacillus of swine erysipelas isolated from urticarial lesions of swine in the United States. Jour. Amer. Vet. Med. Assoc., 1921, vol. 59, p. 131.
[2] A. R. Ward. The etiology of polyarthritis in swine. Jour. Amer. Vet. Med. Assoc., 1922, vol. 61, p. 155.

glistening, grayish white colonies which increased only slightly in size after two or more days' incubation and tended to remain discrete. The growth was never abundant. In broth there was a slight uniform clouding with a small amount of whitish sediment. The organism developed in milk without producing any change in the medium after several weeks' incubation. No visible growth occurred on potato. No indol was produced. Lead acetate agar was blackened in 24 hours. In gelatin stab cultures the growth extended outward from the line of inoculation in fuzzy branches producing the "test-tube brush" appearance described as typical for swine erysipelas cultures. No liquefaction of the medium occurred after 3 weeks' incubation at 20° C. Solid serum gave a delicate growth with no liquefaction of the medium. The following sugars were attacked with the formation of acid, but no gas: Dextrose, lactose, maltose, galactose and levulose. No acid or gas was formed in saccharose, salicin, mannite, dulcite, raffinose and arabinose.

PATHOGENICITY

White mice inoculated intraperitoneally with 0.1 c.c. of a 24-hour broth culture succumbed in from 3 to 5 days. Pure cultures were obtained from the heart's blood and organs of the mice. Pigeons died in about 3 days following intravenous injection of 1 c.c. of a 24-hour broth culture. The organism was recovered from the muscles, blood, and liver of the pigeons. Rabbits were made ill for a day or two by intravenous inoculations, but recovered. Guinea-pigs proved completely refractory. An eight-weeks-old pig was injected intravenously with 1 c.c. of a 24-hour broth culture (second generation on artificial medium), and a boar about 10 months old was intravenously injected with 1 c.c. of a four-day broth culture (third generation on artificial medium). No symptoms of illness developed in either case during a period of observation extending over 3 weeks. An eight-weeks-old pig inoculated subcutaneously with 1 c.c. of a 24-hour broth culture (second generation) remained healthy.

From the foregoing description it will be seen that our organism agrees in all essential morphologic, staining and cultural characters, as well as pathogenic properties, with the bacillus of swine erysipelas.

POSTMORTEM FINDINGS

The following notes were taken at the autopsy of the pig:

The skin of the snout is slightly reddened. Elsewhere no gross alterations are observed in the skin or subcutaneous tissues. The cervical and inguinal lymph glands are somewhat enlarged and reddened. There is a small quantity of clear serous transudate in the pleural cavity. Both lungs are congested. A few petechiae are present on the auricles and coronary region of the heart. There is no evidence of endocarditis or valvular lesions. The peritoneal cavity contains a slight excess of fluid. There are several red, eroded areas in the mucosa of the pyloric region of the stomach. The mucosa of the small intestine is considerably reddened for the greater part of its extent. A few petechiae are present in the cortex of the kidneys. No gross alterations are found in the spleen. The mesenteric lymph glands are enlarged and reddened. The carcass is in a very well nourished condition.

HISTORY

The owner of the pig furnished the following history:

The farm on which the pig was raised is located in Virginia not far distant from Washington. For about four years previous to last fall, when three purebred Poland-China sows were bought, no hogs had been kept on the premises. The sows, which were purchased with the understanding that they were cholera immune, were placed in the old hog lot, and this spring each sow farrowed a litter of pigs. During the morning of April 1, three of the pigs of one litter, which were apparently healthy the evening before, were found dead in the pen. The pig brought to the laboratory was one of these animals. The sow with these pigs appeared only slightly off condition at this time, but a few days later became very much worse and on April 6 refused all food. On April 7 the sow's temperature was 106.5°, and it was thought that she would not survive. Another of the sows was also ill for several days at the same time that the first sow sickened. This animal was dull and off condition, but did not completely lose its appetite. On April 7 its temperature was 104.2°. The third sow, which had not been in contact with the other animals, remained healthy. On April 3 the suckling pigs, 14 in all, appeared well and were injected with 20 c.c. hog-cholera serum alone. No losses oc-

curred amongst the pigs during the following three weeks. On April 7 each of the three sows was injected with 3 c.c. hog-cholera virus and 150 c.c. serum. The two sows which were ill at this time made an almost complete recovery within about a week and since then have not been off feed. The third sow remained healthy following vaccination.

DISCUSSION

It is unfortunate that all of the material which we had for study was disposed of before we could undertake inoculation tests for determining the presence of cholera virus. The definite exclusion of cholera in this case, we believe, would have materially strengthened the diagnosis of acute swine erysipelas. In spite of the fact that the erysipelas organisms were found in large numbers and in pure culture in the blood and organs of the pig, there may yet be doubt in the minds of some that this is an uncomplicated case of acute swine erysipelas.

Dr. G. J. Gruenwald was transferred from Madison, Wisconsin, on hog-cholera control to the same class of work in West Virginia, with headquarters at Charleston, effective June 19, 1922.

Dr. Herman Greeder, attached to the Bureau force on hog-cholera control in Oklahoma, resigned from the service June 1. The vacancy thus created is being filled by the transfer of Dr. G. E. Abrams from Pierre, South Dakota.

Dr. J. A. Grau, for a number of years assigned to hog-cholera work in Nebraska, is being transferred to Olympia, Washington, to conduct the same class of activities in that State.

Dr. J. F. Chipman has been transferred from Frankfort, Kentucky, to Troy, Alabama, effective July 1. Dr. Chipman will continue in hog-cholera work.

Dr. H. E. Smith goes from hog-cholera work in Nebraska to the same class of work in Texas, effective July 1.

Dr. E. E. Clore, who has been assigned to hog-cholera work in Indiana since 1918, has been transferred to South Dakota to engage in the same class of activities.

Dr. A. M. Meade has been transferred from hog-cholera control work in Illinois to a similar project in Georgia. Dr. Meade reported to Dr. A. L. Hirleman at Atlanta on July 10.

MISCELLANEA ANATOMICA

II. A NOTE ON THE THORACIC AND LUMBAR VERTEBRAE OF THE HORSE

By SEPTIMUS SISSON

Professor of Anatomy, College of Veterinary Medicine, The Ohio State University, Columbus, Ohio

IN the December, 1921, number of the JOURNAL there appeared a communication from Dr. Schwarzkopf entitled "The Occurrence of Five Lumbar Vertebræ in the Morgan Horse." This was written in response to a request by the Editor in the September number for information concerning this matter and closely related data.

The present writer is somewhat diffident about discussing this topic, since he has had exceedingly little opportunity to make observations on purebred Arab and Morgan horses, and has been unable to obtain any considerable amount of data based upon careful studies by competent observers of these types. He has had, however, opportunity to observe the dissection of a large number of horses of various types during the past thirty years, and during the last decade has been specially interested in the subject of costal and vertebral variations in the horse. A few observations on this general topic may be of some interest. No attempt will be made here to go into the literature of the subject, but a few references will be appended for the benefit of those who may wish to use them.

In the first place we must agree as to how exactly we distinguish between thoracic and lumbar vertebræ. For the present purpose at least the usual understanding is that thoracic vertebræ are characterized by the presence of facets with which ribs articulate, while lumbar vertebræ have instead a lateral extension on each side which is termed the transverse process. This distinction is simple and is sufficient in those cases in which it can be used. But unfortunately this criterion fails in many cases. In many horses there is an ambiguous vertebra at the thoraco-lumbar junction. Most often apparently the atypical vertebra is the twenty-sixth. A simple and frequent form of the variation is that in which the vertebra is typically thoracic on one side and lumbar on the other. Another is the existence

of a costiform process or extension of the transverse process on one side or both. This often resembles the usual eighteenth rib so closely that it would be so diagnosed in examining the living subject and might even escape notice or proper interpretation in dissection. The costo-transverse process, if we may so designate it provisionally, may be fused with the body of the vertebra or form a diarthrosis with it.

In a good many horses the twenty-sixth vertebra has on each side a facet for articulation with a rib which differs in no important way from the usual eighteenth rib. In the great majority of such subjects there are five succeeding vertebræ which are typically lumbar. In a small number of cases in the draft, grade and light horses (exclusive of Arabs and Morgans) which the writer has observed these and other variations which can not be detailed here involve the twenty-fifth vertebra. In them the presacral vertebræ which were clearly lumbar in type were usually six in number, but in a very few cases there were only five.

The American Museum of Natural History has, it is generally conceded, the best and most extensive osteological collection relative to ancestral and existing Equidæ. Last spring the writer addressed an inquiry to the Museum for information derived by the Museum workers from this collection bearing upon the topic now under discussion, and asking especially for phylogenetic data which might throw some light on the significance of the numerical and morphological variations which are observed in existing Equidæ. Mr. S. H. Chubb, an experienced member of the Museum staff, kindly replied to this request, and his statement is almost verbatim as follows:

It seems to me that the short back, which might tend toward the reduction of ribs, is the more highly specialized type. On the other hand, the occurrence of an extra pair of ribs in the modern Equidæ is generally, though not always, at the expense of the lumbar region, and hence does not affect the total number of back (thoraco-lumbar) vertebræ.

Of course it is the ancestral horses which should be expected to answer this question. Although we have a remarkable collection of fossil Equidæ, it is unfortunate that in almost every specimen there are a few vertebræ missing, so that they give us little information on this point.

In looking over our collection of about thirty-five specimens of the modern Equidæ it is interesting to note that in *Equus caballus* there are comparatively few exceptions to the rule of 18-6. These exceptions are included in the inclosed list (vide infra). You will note that the Arab, which we regard as a distinct species, is among these

exceptions. In looking over my letter I fear I have rather evaded your question, but the truth is there are so many points unsolved even though we have a very good study collection.

The table, so far as it relates to existing horses, is as follows:

	Dorsal or rib-bearing vertebræ	Lumbar vertebræ
Arabian	18	5
do.	18	5
do.	17	6
Arabian-Trotter cross	18	5
Common horse	19	6
do.	19	6
do.	19	5
Trotter, probably much Arabian blood	18	5
Morgan, probably much Arabian blood	18	5
Prjevalsky horse	19	5
do.	18	6
do.	18	6
do.	18	6

This table does not, of course, provide a sufficient basis for conclusions of any great value. It tends to indicate, however, the probability that further careful observations may show that purebred Arab horses and others which have in them much Arabian blood commonly possess only 23 vertebræ in the back and loins, of which five are usually lumbar. One exception appears among the six listed in the table, that of an Arab with 6 lumbar vertebræ and 17 thoracic. The four Prjevalsky horses listed all have 24 vertebræ in the back and loins; one of these has the formula 19-5, the other three have 18-6.[1] The writer is inclined to the view that this finding is in pretty close conformity with the condition found in the majority of existing horses, with the possible exception of the Oriental type. Last month we dissected a grade draft mare (chiefly of Percheron blood) of which the seventeenth vertebra in the back was thoracic on one side and lumbar on the other, and there were five typical lumbar vertebræ. Apparently no certain means has been devised by which one may recognize the existence of the nineteenth rib in the living horse. The evident existence of a rib more on one side than on the other is not diagnostic. It seems plausible to suppose that one could depend on the distance between the tuber coxæ (external angle of ilium) and the last rib, but this does not appear to be a reliable criterion

1 Salensky in his monograph on *Equus prjevalskii* gives the number of thoracic vertebræ as 18 and the lumbar as 5.

as to whether there is an additional rib on one side or a reduction on the other side. It can only be said that experience enables one to "guess right" rather frequently. Of course the matter could be cleared up by the use of X-rays.

It might naturally be supposed that there would be a direct relation between shortness of the loin and the existence of five lumbar vertebræ. In the opinion of the writer this inference is unsafe, and he has been unable to find data of scientific value which establish a direct relationship between the length of the back and the number of vertebræ. On the other hand we find ample illustration of the lack of such a correlation.

The writer is unable to agree with Dr. Schwarzkopf in his view that observations strongly indicate the existence of a tendency to eliminate the sixth lumbar vertebra in breeds used under the saddle. Numerical reduction could occur by coalescence or agenesis of segments, and the facts in this regard would have to be determined by embryological investigation. Phylogenetic studies might throw some light on the question. The occurrence of ankylosis of variable extent in this region is, of course, quite common, especially in old horses. But there seems to be no good reason, at present at least, to assign to this process any significance other than the generally accepted view that it is traumatic.

The question of the mechanical value of the short back is one upon which the opinion of a mere anatomical worker is of little value. It would seem that this conformation would be stronger and better adapted for carrying weight, but would be inferior in elasticity, especially if the number of vertebræ is reduced. In studying the mechanism of the back and loins the vertebræ should be considered in two other respects: (1) The line formed by the summits of the spinous processes is of course quite evident in the living animal. (2) The direction of a line passing through the bodies of the vertebræ is in great part different from the preceding and forms the real vertebral axis. In the loins and the posterior end of the back the two lines are practically horizontal and parallel. The highest point of the withers is preferably about two inches higher than the highest part of the croup. The vertebal axis, on the other hand, curves very decidedly downward in its anterior part. Curvature in its lumbar part is normally slight. Many skeletons are mounted

incorrectly in these respects and in other ways as a natural consequence.

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DR. MOORE LEAVES ST. JOSEPH VETERINARY COLLEGE

Dr. R. C. Moore, for a number of years Dean of the St. Joseph Veterinary College, has discontinued his official connection with that institution and turned over its management to Dr. F. M. Cahill.

Dr. Moore has suffered a nervous breakdown that was seriously affecting his eyesight and heart, and his physician advised him to discontinue all heavy strain upon his nervous system. He has accepted a position with the Jensen-Salsbery Laboratories, of Kansas City, Mo., and will establish a distributing point in St. Joseph which will furnish him the outdoor exercise recommended for the restoration of his health.

Advice has just been received from the New York Veterinary College, New York University, New York City, to the effect that operations have been temporarily suspended. This action was recommended at the recent meeting of the Alumni Association of that college and was concurred in by the Chancellor of the University.

George Oberholtzer, a master-truckman of Philadelphia, said at a meeting held in that city, May 10, 1922, "Three years ago I had 23 motor trucks and no horses, now I have 46 horses and only five motors, and am ready to dispose of these five."

CLINICAL AND CASE REPORTS

(Practitioners and others are invited to contribute to this department reports of unusual and interesting cases which may be helpful to others in the profession.)

A FATAL CASE OF RABIES IN MAN

By B. Scott Fritz

Agent in Charge, Pennsylvania Bureau of Animal Industry, Philadelphia, Pennsylvania

THE HEAD of a dog suspected of rabies was sent to the laboratory of the Pennsylvania Bureau of Animal Industry May 19, 1922, by Dr. Edgar W. Powell, a practicing veterinarian of Bryn Mawr, for diagnosis. The laboratory diagnosis was positive.

History.—On May 14, 1922, a white beagle dog with brown ears, the owner of which was not known, in the vicinity of Ardmore, bit a child badly about the face. The father of the child that was bitten, being familiar with the danger accompanying a dog bite, informed the police of Ardmore of the case, who caught the dog and turned it over to Dr. Powell, who in turn held it under observation. On May 19 the dog showed clinical symptoms of rabies and was killed, and the head was forwarded to the above mentioned laboratory for a confirming diagnosis. The laboratory diagnosis was positive to rabies and the parent of the child bitten was notified by telephone. An attending physician was called and the Pasteur treatment was given. The treatment, so far as we know to date, was successful.

On June 5 a physician at Villa Nova College called this laboratory, requesting of us any history of rabies in that vicinity. We informed him of the above mentioned case as cited. He in turn informed us of having under his observation a student at the college showing symptoms of which he was suspicious of rabies, and stated that if he could associate rabies with a bite this student had received on May 14 a diagnosis of rabies would be certain.

By investigation through our Bureau, the attending physician and the Ardmore Bureau of Health, it was proved that the dog which had bitten the child also bit the student, on

the same date. The student saw the dog lying in the gutter on the morning of May 14, in Ardmore, and thinking the dog had been run over by an automobile, stopped to pet it, and the dog jumped up and bit him on the lip. The student not being alarmed by the nature of the bite, had the wound cauterized and forgot the incident until being brought under the observation of the physician.

On June 7 the student died, showing typical symptoms of rabies. The student's brain was brought to our laboratory and the physician's positive diagnosis of rabies was confirmed.

Conclusion.—Observe from the case cited that the dog bit the child and the student about five days before having shown clinical symptoms. The Pasteur treatment was given the child immediately after the date of the laboratory diagnosis of rabies in the dog. The student did not receive antirabic vaccine and showed symptoms of rabies in about twenty-one days after the date of the bite, and died on the twenty-third day. A positive diagnosis of rabies was made in our laboratory.

SOME CLINICAL DATA FROM NORMAL SHEEP URINE

By JAMES F. COUCH

Pathological Division, Bureau of Animal Industry, Washington, D. C.

IN THE COURSE of the investigations of stock-poisoning plants conducted by the Bureau of Animal Industry there are frequent analyses made of the urines from experimental animals. This has been done as a matter of clinical routine for several years and a considerable mass of data has accumulated. Much of this refers to normal animals. Inasmuch as the literature on the subject of the constants of normal urine from the sheep is meager, it was thought that the recording of these data in this place, where it would be available to those engaged in animal experimentation, would be interesting and important.

Table 1 contains the results obtained from the analysis of 28 samples of urine from normal sheep. The specimens were all obtained at the experiment station at Salina, Utah, maintained for the study of stock-poisoning plants. The sheep were ordinary range animals and were kept under range conditions as far as the nature of the experiments permitted. The alti-

tude of the station is nearly 8,000 feet, and all the animals used were completely accustomed to this altitude when the samples were taken.

The method of obtaining the samples of urine is as follows: The sheep is usually fed a ration of alfalfa hay in the morning and is then put in a metabolism cage and kept there for exactly 24 hours. The cage is large enough so that the animal may move about to some degree and may lie down comfortably. The floor is formed of a heavy wire screen of about ¼-inch mesh under which is a finer screen of about No. 12 mesh. Below this is a galvanized-iron bottom which slopes to a central drain emptying into a screened pipe, and this conducts the urine into a vessel placed to receive it. In spite of the precautions taken, the urine was always contaminated with small amounts of feces. This contamination, however, was never great enough to vitiate the results. The main objection to this method of collecting samples of urine is due to evaporation. Measures to reduce this to the smallest practicable degree were taken, and it is believed that the error due to evaporation was smaller than the errors inherent in the analytical processes, and did not, therefore, affect the results.

As soon as the 24-hour collection period was at an end the urine was thoroughly mixed if, as frequently happened, it was collected in several fractions. A sample was then filtered for analysis, and the analysis was always completed within 12 hours. The color and odor were recorded and the reaction to litmus was determined. The specific gravity was determined with a smaller urinometer, and the routine tests for sugars, albumens, biliary constituents, etc., were made. The urea was quantitatively determined by the alkaline hypobromite method and the liberated nitrogen was measured in a Doremus ureometer. This last method is known to give high results for the urea in human urines and the fact probably holds true also for the urine from animals, but it is accurate enough for clinical purposes. The figures given for urea in Table 1 refer to the total urea excreted in the 24-hour period.

The results obtained were of great interest. Table 2 contains the averages as well as the maxima and minima of the data. Four of these figures are due to the case of Sheep 554, analysis of August 11, 1920. A sample of urine from this animal had also been obtained on August 9 and the results of the analysis

TABLE 1

Date	Sheep No.	Weight (pounds)	Age (years)	Sex	Volume (milliliters)	Specific gravity	Reaction	Total Urea (grams)
1918								
Aug. 24...	469	104	1	Ewe	1,704	1.019	Alkaline	48.78
Sept. 6...	503	93	1	do.	1,525	1.018	do.	32.88
Aug. 28...	472	95.5	1	do.	645	1.029	do.	22.11
Sept. 10...	492	111		do.	760	1.043	do.	35.85
11...	506	124		do.	1,770	1.033	do.	63.89
1920								
July 17...	582	106.25	4	do.	250	1.048	do.	28.00
19...	587	87	1	do.	960	1.017	do.	29.58
26...	600	86.5	1	Wether	930	1.020	do.	36.32
31...	563	101	1	Ewe	109	1.051	do.	10.68
Aug. 1...	605	97	1	Wether	515	1.057	do.	30.58
4...	578	97	1	Ewe	890	1.016	do.	27.42
7...	566	89	1	do.	262	1.032	do.	11.76
9...	554	127	1	do.	515	1.041	do.	41.53
11...	554	127	1	do.	75	1.057	do.	7.45
12...	575	68	1	do.	480	1.030	do.	22.04
16...	579	98	1	do.	985	1.027	do.	26.72
20...	581	74.5	1	do.	435	1.030	do.	32.29
26...	585	85	1	do.	665	1.029	do.	33.90
28...	587	96	1	do.	945	1.020	do.	34.49
29...	590	103.5	1	Wether	870	1.021	do.	27.29
30...	588	105	1	do.	750	1.023	do.	32.48
Sept. 4...	600	94	1	do.	1,110	1.024	do.	35.27
6...	597	98	1	Ewe	400	1.049	do.	24.75
7...	598	120.5	1	do.	815	1.038	do.	25.21
8...	594	114	1	do.	1,115	1.021	do.	37.29
1921								
Sept. 14...	646	118.5	4	do.	1,675	1.018	F. acid	46.45
16...	627	110.5	1	do.	950	1.035	Alkaline	31.61
18...	613	126.75	1	do.	780	1.020	do.	35.98
Average...					810	1.031		31.16

TABLE 2

	Volume (milliliters)	Specific gravity	Urea (grams)
Maximum	1,770	1.057	63.89
Minimum	75	1.017	7.45
Average (28 samples)	810	1.031	31.16

are also given in Table 1. There is no reason to suppose that the animal was at all abnormal when these samples were taken, and the variation simply shows the lack of constancy which animals may exhibit.

In reaction the samples were with one exception alkaline, and generally the degree of alkalinity was smaller in the cases of large volume excretion. In only one case was the urine acid, and in this case the degree of acidity was very small. Substances which reduce Fehling's solution were absent in every case. In one case only was evidence of albumen obtained, and then it was in traces only. In several cases a detailed search was made for acetone bodies, with negative results. The general impression that herbivora excrete very small amounts only

of phosphates in the urine was confirmed in a number of the samples.

The writer desires to acknowledge his indebtedness to Dr. C. D. Marsh for suggestions and criticism and to Mr. A. B. Clawson for extensive assistance in collecting the samples.

NOTES ON PARASITES

By GERARD DIKMANS

Louisiana State University, Baton Rouge, Louisiana

IN THE COURSE of the last month the writer had occasion to make an examination of the intestines of some sheep, killed at the local abattoir, for parasites. The number of sheep killed here is comparatively small, and it behooves us, therefore, to take advantage of all the material that is offered.

PARASITES FOUND IN SHEEP

On examination in the laboratory of the material collected, there were found numerous specimens of *Haemonchus contortus* (stomach worm), *Bunostomum trigonocephalum* (hookworm), *Œsophagostomum columbianum* (nodular worm), *Trichuris ovis* (whipworm), and a great mass of tapeworms.

The genus *Cooperia* was represented by three species, viz., *Cooperia curticei*, *C. punctata*, and *C. pectinata*. Two of these, *C. punctata* and *C. pectinata*, have been reported as parasites of cattle, but the writer is unaware of any record of their having been found in sheep. In B. A. I. Bulletin 127 Ransom has described and figured both of these species, so that any further description appears unnecessary. The writer wishes, however, to call attention to the prominent dorsoventral curvature of the spicules of the male *C. pectinata*. This feature, which is very conspicuous on microscopic examination, seems to have escaped Ransom's notice, and is not mentioned in his description. At the end of his description Ransom states: "This species has been collected but once, a few specimens being present among some nematodes taken from the fourth stomach of a Texas cow."

It may be of interest to note that this nematode is of frequent occurrence in calves slaughtered at the local abattoir here.

The following additions should, therefore, be made to the published descriptions:

Cooperia punctata: Hosts, cattle and sheep.

Cooperia pectinata: Hosts, cattle and sheep. Location, fourth stomach and small intestine. Locality collected, Texas and Louisiana.

FLUKES IN DOGS

On March 28, 1922, three dogs were destroyed at the laboratory, and their internal organs examined for parasites. The material collected contained four small flukes from the small intestines. Dog No. 1 contained one fluke. Dog No. 3 contained three flukes. These flukes were identified by Dr. Hall as *Alaria americana.* The species was first described by Hall and Wigdor (JOUR. AMER. VET. MED. ASSOC., vol. 6 (n. s.), No. 5, pp. 616-626, Aug., 1918). The authors recorded its occurrence at Detroit, Michigan.

This record should be amplified and the localities stated as Detroit, Michigan, and Baton Rouge, Louisiana.

A CYSTIC-NODULAR CONDITION IN AUSTRALIAN CATTLE, DUE TO A NEMATODE WORM, ONCHOCERCA GIBSONI

By E. M. NIGHBERT

Veterinary Inspector, United States Bureau of Animal Industry, London, England

THROUGH the courtesy of Dr. Cherry, representing the Australian Government in veterinary matters at London, England, I forward a photograph which shows the effect in cattle caused by parasitic invasion of *Onchocerca gibsoni.*

This parasite is a hair-like worm reaching the enormous length of 40 inches. It finds its resting place locally in the region of the brisket, stifle and outer side of the hind quarter. Its invasion of the subcutaneous tissues gives rise to cystic-nodular formation, showing prominently in the dressed carcass; therefore, it is of importance in connection with meat inspection and economically from the standpoint of the sale and use of fresh beef. In Australian literature the condition is referred to as "worm nests," "worm nodules," etc. Each nodule ranges in size from a split pea to an average-sized marble, and the nodules appear in the host animal in nest formation.

In the photograph the excision of these nests has been ac-

Australian beef carcasses showing effect of removal of worm nests

complished in the region of the stifle; also it will be noted that the affected brisket has been removed. From one to fifty or a hundred cysts may be found in one animal, always assembled in the areas named. I was informed that the cysts are generally easily removed, without as much mutilation of the parts as the pictures indicate.

So far, it appears, the exact mode of transmission of this parasite to cattle has not been determined. However, a biting

fly and mosquitoes of a certain variety are strongly indicated. This condition of cattle seems to be confined to, or at least originated in, cattle reared on Wilson Island in Northern Australia.

The general health of the host animal is not impaired. The condition has no connection with any disease in man; therefore the flesh is safe for food.

I had the privilege of personally examining a number of affected carcasses in London.

CAESAREAN SECTION IN BITCH WITH NINETEEN PUPS

By H. MEADE HAMILTON
Muncie, Ind.

Subject: Shepherd Police dog.

History: Twelve hours labor, with delivery of three puppies. Two weeks premature.

Symptoms or condition: Bitch had very feeble or practically no expulsive power, could not lie down on account of extreme size and too weak to stand, could only sit down in dog fashion. Pups delivered were dead, but well developed and normal except dropsy of allantoic fluids.

Treatment: Although the bitch had delivered three pups there was no apparent reduction in her size, and due to her extreme weakness and enormous size, I advised the owner that I believed an operation would be the only possible means of saving her and that the prognosis would be unfavorable.

Everything being in readiness, with the animal having one-half grain morphine three-quarters of an hour before, we proceeded to operate at 9:15 p. m., June 9, 1922. Ether was used

as a general anesthetic, taking very little of it to produce surgical anesthesia.

Strict asepsis was followed throughout the entire operation. It was necessary to open both cornua of the uterus. The operation was finished and the bitch made comfortable. I then proceeded to count the number of pups, which I will say was so great that I could not keep count at the time of removing them. The number was sixteen besides the three delivered naturally before the operation, making nineteen well-developed, normal pups in all.

The bitch was given 5 c.c. of camphorated oil before the operation and 5 c.c. following the operation. I also gave 15 c.c. of flavisol in the peritoneal cavity, following the next day with the same amount, and 5 c.c. of camphorated oil three times a day the same day. The animal was allowed some light food June 10, which she took, but she was very weak and could not stand alone. Improvement, however, was rapid and the bitch made a complete recovery in ten days.

Immediately following the above operation, I operated on a small white poodle bitch, which had been in labor for four days. This bitch had one pup, and it lay with hind quarters in one cornu and head in the other, with front feet in body of uterus and pelvic cavity. The fetal membranes were completely sloughed away, with the characteristic greenish discharge present. This bitch made a complete recovery and is doing fine at present writing.

A CASE IN CANINE PRACTICE

By G. W. BROWNING
Mobile, Alabama

EARLY in the morning of May 27 Mr. T. brought a two-months'-old Bull puppy to my office for treatment; said the pup had kept the family awake by his howling for the past two nights, and had not eaten a thing since the 25th. I watched him a few minutes and noticed that he would hump up his back and try to defecate every few minutes, and he kept yelping and howling every few seconds, showing the most excruciating pain somewhere. He kept up this periodical howling all day the 27th and until about 3 p. m. of the 28th.

I diagnosed the case as acute toxic gastroenteritis with impaction of the bowels, as they had been feeding him as an old dog should have been fed. I first gave him a gastrohepatic pill to endeavor to move his bowels, and followed this with enemas to try to hasten an operation, for I saw that he must have relief soon or die.

After six hours he vomited up the pills, which were dissolved. No operation and no better. He made so much noise that the neighbors near by could not sleep and were going to have my hospital condemned.

At 3 p. m. he was no better, still howling and shifting around. The owner came in and said: "I think a good deal of that pup and value him very highly, but I am tired of seeing him suffer so much, and I want you to chloroform him." I told him to let me try my old stand-by, and then if he did not get an operation of his bowels and stop yelling I would chloroform him.

I loaded my hypodermic syringe with 1/60 grain of lobelin and gave him a shot. He keeled over with a spasm and lay for a few seconds like dead. The owner said, "He won't need the chloroform now, for he is dead." But in a few seconds he got up, staggered around a while, and finally lay down and slept most of the time until the morning of the 29th, with no more howling. He had an operation of the bowels about 8 p. m. the 28th, of very hard feces rolled up with worms. No appetite yet.

The morning of the 29th he was lying in his box like a dead puppy, and I had about decided that the end was near, for he had been sick so long and had gone five days without eating anything. I went into my office and got my cone and chloroform to end the scene, but to my surprise I met him coming to meet me, with his tail up over his back as if nothing had happened. He appeared from his manners to be nearly starved. I gave him some milk instead of the chloroform. He licked it up in a hurry and wanted more. I restricted his diet for 24 hours, and he made a nice recovery.

Remarks.—We never get too old to learn. I had long abandoned routine treatment in my practice as much as possible, but where I made my mistake in this case was by not giving the lobelin first and emptying out the stomach. Then he would have retained the pill and assisted the pill through relaxation of the system, which I have proved in a few cases since that

time. If I had given the lobelin first in this case I would have saved at least two days' howling and been on better terms with my neighbors.

OBTURATOR PARALYSIS

By C. J. MARSHALL,

University of Pennsylvania, Philadelphia, Pa.

THE SUBJECT was a Holstein cow eight years old in good physical condition. Calved in a box stall Sunday night without assistance. Monday morning a normal, healthy calf was found but the dam was unable to get up. Was seen by the Ambulatory Clinic the following Tuesday. A fracture of the pelvis was suspected. There was no crepitation and a rectal examination revealed nothing abnormal. An unsuccessful effort was made to get the animal on her feet. The cow made an effort to get up but would assume the position of a frog with the hind legs strongly abducted. A diagnosis of obturator paralysis was made from the fact that the case appeared unable to adduct the legs. The legs were tied together with ropes and another unsuccessful effort was made to get her on her feet. Tincture of nux vomica prescribed and instructions left for trying to lift her with ropes each day. The cow could turn from side to side without assistance. We saw her one week later and found no improvement; was still unable to get on her feet even with assistance and had lost weight rapidly. Several bed sores had developed around the knees, hips and stifle joints. The animal was destroyed to prevent further suffering.

The autopsy findings showed a well marked lesion in each obturator nerve on the floor of the pelvis at the border of the foramen. The lesion of the nerve at these points was about three times the thickness of the normal nerve and practically one inch in length. There was a gelatinous mass around the enlarged portions. These cases are sometimes spoken of as straddlers and are seen quite often in stockyards where fresh cows or heavy springers are handled.

We believe this case might have recovered if treatment had been given sooner.

When the exposed condition of the obturator nerve is considered, it is surprising that it is not more frequently injured in difficult or even normal parturition.—*U. of P. Bulletin, Veterinary Extension Quarterly, No.* 6, *April* 1, 1922.

ABSTRACTS

NOTES ON TREATING MASTITIS WITH FORMALIN. A Savage. Veterinary Journal, vol. 78 (1922), No. 5, p. 174.

Savage recommends internal medication with formalin in one-ounce doses twice daily for sows as large as or larger than the average Ayrshire. The formalin may be given in a capsule or as a drench in a quart of very cold water. The formalin treatment should be supplemented by a brisk saline purge and repeated massaging of the udder and stripping of its milk many times daily.

The formalin treatment will not reduce an indurated quarter nor prevent abscess formation when that process is under way. In chronic cases it is not so useful as in acute forms of the disease. It is most successful when applied early and thoroughly.

L. T. GILTNER.

JOHNE'S DISEASE AND ITS DETECTION. B. A. Beach and E. G. Hastings. Jour. Infect. Diseases, vol. 30 (1922), No. 1, pp. 68-79. (Abst. in Expt. Sta. Record, vol. 46, p. 682.)

Following a brief discussion of the nature and distribution of Johne's disease, a report is given of an investigation of the disease at the Wisconsin Station, including attempts at isolation of the organism, the preparation of diagnostic johnin, its application in a number of herds, and the confirmation of the test by constitutional reactions, retests on reacting animals, and macroscopic and microscopic postmortem examination of reactors.

In one herd, which was known to have been infected for 14 years previous to the time the work was begun, 7 tests were made at intervals of from 3 to 6 months from June, 1917, to December, 1920. The number of reactors found in the successive tests were 5, 4, 6, 3, 4, 4, and 2. On repeating the test in June, 1921, no reactors were found, but it is not deemed at all certain that additional reactors will not be found in future tests. The specific organism was found in all but 1 of the 28 animals reacting to johnin, thus showing the reliability of the test when positive.

Observations of the spread of the disease in several herds in-

dicate that the disease at times spreads very rapidly and at other times very slowly.

RELAPSING FEVER IN PANAMA: THE HUMAN TICK, ORNITHODOROS TALAJE, DEMONSTRATED TO BE THE TRANSMITTING AGENT OF RELAPSING FEVER IN PANAMA BY HUMAN EXPERIMENTATION. L. B. Bates, L. H. Dunn and J. H. St. John. Amer. Jour. Trop. Med., vol 1. (1921), No. 4, pp. 183-210. (Abst. in Expt. Sta. Record, vol. 46, p. 682.)

This is a report of investigations conducted by the authors at the Board of Health Laboratory and Ancon Hospital, Canal Zone.

In the course of the work two white rats were infected with relapsing fever by inoculating them with a suspension of macerated naturally infected *O. talaje* ticks. Typical spirochetes were found in naturally infected ticks in Panama. One *Macaccus rhesus* monkey was infected with relapsing fever of Panama by feeding a number of *O. talaje* larvæ upon an infected white rat, and 22 days later allowing the same ticks as first stage nymphs to feed upon the monkey.

Three human volunteer patients were infected with relapsing fever, as follows: "The first by a subcutaneous injection of blood from a white rat which had been infected with relapsing fever by a combined subcutaneous and intraperitoneal injection of naturally infected ticks, the second by a hypodermic injection of a suspension of naturally infected ticks, and the third through the bite of naturally infected ticks." Thus it has been proved by human experimentation that *O. talaje* transmits the causative agent of relapsing fever in Panama.

Dr. and Mrs. George A. Roberts have arrived in the United States after a five-year residence in Brazil, where the doctor had a contract with the State of Sao Paulo. Their present home is at Rock Hill, South Carolina.

Dr. Wm. M. Bell, of Nashville, Tenn., states that "the most important procedure in the treatment of tetanus, is the thorough dissection of all devitalized and infected tissues at the seat of the primary infection. Go well around it and deep enough to be sure to get it all, and see what a difference."

ARMY VETERINARY SERVICE

CAPT. VULLIAMY DECORATED

Dr. H. F. Vulliamy

Dr. H. F. Vulliamy, of Donaldsonville, Louisiana, has just been awarded by the British War Office the Victory Medal and the British Service Medal.

Dr. Vulliamy joined the horse and mule transport service in 1914, and for three years and three months made voyages to England, Greece and Egypt. He was then offered a commission as first lieutenant in the Royal Army Veterinary Corps, and went to France, where he remained till after the armistice was signed.

He resigned his commission in 1920, having attained the rank of captain, and returned to the United States, and is now located in Donaldsonville, La.

The Doctor is a veteran of the Spanish-American War, and has crossed the "Herring Pond" forty-nine times, forty-one of his voyages having been made during the Great War. He made a splendid record in the transport service.

ARMY CALLS[1]

By MAURICE C. HALL

Washington, D. C.

(*Tune of "Smiles"*)

There's the "First Call" in the morning,
There's the call of "Taps" at night,
There's the "Sick Call," "Come and get your quinine!"
There's a call for "Column left" or "right,"

[1] Written for the third annual dinner of the Helminthological Society of Washington.

There's the stirring call of "To the Colors,"
There's the hateful sound of "Reveille,"
But the good old "Mess Call," "Come and get it!"
Is the call that appeals to me!

(*Tune of "Reveille"*)

I can't get 'em out!
I can't get 'em out!
I can't get 'em out in the morning!
I can't get 'em out!
I can't get 'em out!
I can't get 'em out at all!

The tapeworm's worse than the ascarid,
The pinworm's worse than the tapeworm,
The hookworm's worse than the pinworm,
And the lungworm's worst of all!

EPITAPHS TO HORSES

The old-time frontiersman's horse was close to his heart, and sometimes received the tribute of honorable burial when the end came, says *The Outlook* in a recent issue. Some of the inscriptions above the graves of these favorite horses, as quoted in "The Cowboy," by P. A. Rollins, tell the story with simple eloquence. Here are three:

JIM

a reel hors
oct. 1, 82

HERE LIES
"I'M HERE"

The Very Best of Cow Ponies,
A Gallant Little Gentleman.
Died on this Spot, Sept. 3, 1890.

HERE LIES
"WHAT NEXT"

Born ....., 1886 at .....;
Died July 16, 1892, near Ft. Washakie, Wyo.
He had the Body of a Horse,
The Spirit of a Knight, and
The Devotion of the Man who
Erected This Stone.

In a belated announcement of honors bestowed by the Belgian Government for service during the war are the names of fifteen army veterinarians decorated with the war cross with palm "for courage and devotion of which they gave proof in the course of their long presence at the front."

ASSOCIATION NEWS

A. V. M. A. CONVENTION

The program for the fifty-ninth annual meeting of the American Veterinary Medical Association at St. Louis, Missouri, August 28 to September 1, 1922, so far as it has been completed, is given below.

MONDAY, AUGUST 28, 10 A. M.

Call to Order ..... President A. T. Kinsley
Address of Welcome ..... Governor Hyde
Response ..... Dr. Tait Butler
President's Address ..... Dr. A. T. Kinsley
Presentation and adoption of minutes.

MONDAY, 1:30 P. M.

General Session

Report of Executive Board.
Election of New Members.
Report of Secretary.
Report of Treasurer.
Report of Salmon Memorial Fund Committee.
New Business.

MONDAY EVENING

President's Reception, 8 to 9.
Dancing, 9 to 12.

TUESDAY, AUGUST 29, 9:30 A. M.

Section Meetings

Section on General Practice.
Section on Sanitary Science and Police.
Section on Education and Research.

TUESDAY, 1:30 P. M.

General Session

Report of Executive Board.
Election of Officers.
Report of Committee on Closer Affiliation with State and Local Associations.
Unfinished Business.
New Business.

TUESDAY EVENING

Meetings of College Alumni, Clubs and Associations.

WEDNESDAY, AUGUST 30, 10 A. M. AND 1:30 P. M.

Clinics at East St. Louis.

WEDNESDAY, 8 P. M.

Smoker and Round Table, Planters Hotel.

THURSDAY, AUGUST 31, 10 A. M. AND 1:30 P. M.

Clinics at East St. Louis.

THURSDAY, AUGUST 31, 8 P. M.

General Session, Planters Hotel

Address, "The Veterinarian's Relation to Agriculture," Hon. Clarence Ousley, Fort Worth, Texas.
Address, "The Change in Veterinary Practice," Dr. W. B. Welch, Lexington, Ill.
Address, "Relation of the Veterinarian to the Public," Dr. Tait Butler, Memphis, Tenn.

FRIDAY, SEPTEMBER 1, 9 A. M.

General Session

Address, "The Present Status and the Future of the Veterinary Profession in Various European Countries," Dr. A. Eichhorn, Pearl River, N. Y.
Address, "The Present Status of the Army Veterinary Corps, Including the Reserve Corps," by a representative of the Veterinary Corps, U. S. Army.
Address, "Present Problems in Our Animal Industry," Dr. J. R. Mohler, Washington, D. C.

FRIDAY, 1:30 P. M.

Report of Executive Board.
Reports of Committees.
Unfinished Business.

SECTION ON SANITARY SCIENCE AND POLICE

First Session

Chairman's Address ..... Dr. R. C. Reed, College Park, Md.
Secretary's Report ..... Dr. H. Preston Hoskins, Detroit, Mich.
Observations on the So-called Hog "Flu" .....
Dr. M. Dorset, C. N. McBryde and W. B. Niles, Bureau of Animal Industry, Washington, D. C.
Equine Infectious Anemia .....
Capt. R. A. Kelser, Army Medical School, Washington, D. C.
The Control of Equine Infectious Abortion in the United States Army .....
Capt. George H. Koon and Capt. R. A. Kelser, Veterinary Corps, U. S. Army.
The Value of Animal Experimentation to Veterinary Medicine .....
Drs. J. G. Hardenbergh and S. D. Brimhall, The Mayo Clinic, Rochester, Minn.

Second Session

Tuberculosis in Its Relation to the Feeding and Marketing of Livestock .....
Prof. H. R. Smith, Live Stock Commissioner, Union Stock Yards, Chicago, Ill.
Facts and Interpretations Relating to Infectious Abortion in Cattle and Swine ..... Dr. J. W. Connaway, Columbia, Mo.
Election of Section Officers.

SECTION ON EDUCATION AND RESEARCH

First Session

Chairman's Address .....
Dr. F. W. Chamberlain, Michigan Agricultural College, East Lansing, Michigan.
Secretary's Report .....
Dr. Leonard W. Goss, Ohio State University, Columbus, Ohio

The Role of the Udder and Its Secretions in Bovine Infectious Abortion
Drs. W. Giltner, I. F. Huddleson and R. L. Tweed, Michigan Agricultural College, East Lansing, Mich.
Preliminary Report on the Differentiation of the Various Organisms Belonging to the Hemorrhagic Septicemia Group
Drs. C. P. Fitch and E. N. Nelson, University of Minnesota, St. Paul, Minn.
The Character and Possible Significance of the Bang Abortion Bacillus that Attacks Swine
Dr. W. E. Cotton, B. A. I. Experiment Station, Washington, D. C.
Investigations on the Immunology of Swine Plague
Drs. R. R. Birch and J. W. Benner, New York State Veterinary College, Ithaca, N. Y.

Second Session

The Veterinary Curriculum: Some Suggested Changes
Dr. V. A. Moore, New York State Veterinary College, Ithaca, N. Y. Discussion by Drs. D. S. White, C. H. Stange and L. A. Klein.
Some Attempts to Control Strongyles in Aneurisms by Means of Intravenous Injections of Drugs
Drs. Maurice C. Hall and Jacob E. Shillinger, B. A. I. Zoological Division, Washington, D. C.
Studies in the Tuberculosis Complement-Fixation Test of Cattle
Drs. John A. Kolmer, Dermatological Laboratories, and Fred Boerner, Jr., Pennsylvania B. A. I., Philadelphia, Pa.
Investigations of Hemorrhagic Septicemia in Swine
Dr. A. F. Schalk, Agricultural College, North Dakota.
Election of Section Officers.

SECTION ON GENERAL PRACTICE

(*Partial Program*)

Vaccination for Hog Cholera from a Practitioner's Standpoint
Dr. George A. Young, Syracuse, Nebr.
Dystocia in the Bitch Dr. F. O. Killian, St. Louis, Mo.
The Handling of Fistula of the Withers in Practice
Dr. B. W. Conrad, Sabetha, Kans.
Dispensing as an Asset to the Veterinary Practitioner
Dr. Charles W. Bower, Topeka, Kans.
Some Important Points Concerning Mastitis
Dr. Louis A. Klein, Philadelphia, Pa.
Pathology of Sterility. (Illustrated.) Dr. W. L. Boyd, St. Paul, Minn.
Why the Practicing Veterinarian Should Be Recognized and Appreciated by the State and Federal Officials
Dr. J. C. Ferneyhough, Richmond, Va.
Some Practical Experiments with Necrotic Enteritis in Swine
Dr. C. H. Honeywell, Slater, Mo.
An Accredited Herd Plan of Value to the Practitioner
Dr. D. H. Udall, Ithaca, N. Y.
The Acriflavine and Proflavine Preparations in Bovine Practice Dr. E. J. Frick, Manhattan, Kans.

SMALL-ANIMAL PRACTICE SESSION

Gastroenteritis in Small Animals Dr. O. V. Brumley
X-Ray in Canine Practice Dr. G. P. Frost
Diseases of the Eye Dr. H. J. Milks
Gastrointestinal Parasites of Dogs and Cats and Treatment for Removing These Parasites Dr. Maurice C. Hall
Sequels of Canine Distemper Dr. W. E. Muldoon

Clinic

Abdominal Surgery ..... Dr. W. G. Brock
Microscopic Demonstration of Diseases of Dogs ..... Dr. R. P. Marsteller
Illustrated Talk and Practical Demonstration of Anesthesia for Small Animals ..... Dr. J. G. Hardenbergh

In addition to the foregoing there will be on exhibition a number of interesting cases that will be presented and lectures given by some of the best men available.

PROGRAM OF CLINICS

WEDNESDAY

8 to 9 a. m. Demonstration of Tuberculous Reactors ..... Dr. D. F. Luckey
9 to 10.30 a. m. Demonstration of Gravid and Pathological Uteri ..... Dr. W. L. Boyd
10.30 a. m. to 12 m. Sterility Demonstration ..... Drs. DeVine, Boyd and Bemis
1 to 2.30 p. m. Poultry Clinic ..... Dr. B. F. Kaupp
2.30 to 3.30 p. m. Sheep Clinic ..... Dr. I. E. Newsom
3.30 to 5 p. m. Parasites of Hogs and Sheep ..... Dr. Maurice C. Hall

THURSDAY

8 to 9.30 a. m. Surgery of the Udder ..... Dr. T. H. Ferguson
9.30 a. m. to 12 m. Swine Diseases ..... Dr. J. W. Joss
1 to 2.30 p. m. Demonstration of Tuberculous Lesions from Slaughtered Reactors ..... Dr. J. S. Jenison
2.30 to 5 p. m. Nerve Blocking and Lameness Clinic in horses ..... Dr. L. A. Merillat

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RAILROAD ARRANGEMENTS FOR A. V. M. A. MEETING

Reduced rates of one and a half fare on the certificate plan have been granted by all railroads for the A. V. M. A. convention. Buy a ticket to St. Louis at the regular fare, but *be sure to get a certificate* (not a receipt) from the ticket agent. This certificate, when signed at St. Louis, will entitle the holder to the reduced rate for the return trip.

The Wabash has been selected as the official route and offers special accommodations. Special train leaves Chicago, Dearborn Station, Sunday, August 27, at 11:45 p. m. For particulars address Mr. John Maloney, Assistant General Passenger Agent, Wabash Railway Co., 144 South South Clark Street, Chicago, Ill.

THE CONVENTION CITY

A HAPPY CHOICE fixed upon St. Louis as the meeting place for the A. V. M. A. Although St. Louis is a large, modern city with a population of 780,000 (which the suburbs increase to over 1,000,000), and is largely given over to commerce and manufacture, it retains its charm as a place where the arts and sciences are cultivated, where time is found and facilities are provided for recreation, and where a friendly hospitality is in evidence.

The city occupies a water front of 19 miles on the great Mississippi River and extends back over an area of more than 60 square miles. It has regular streets that make it easy for the visitor to get about. Its magnificent Forest Park, covering 1,400 acres, is the city's playground and the visitor's delight. The steamboats on the Father of Waters provide pleasant and interesting trips, reminiscent of earlier days. The Missouri Botanical Garden is the finest in the United States. The water filtration plant, representing an expenditure of $30,000,000, is of recent construction and embodies the most modern ideas. The educational facilities comprise two major universities, numerous smaller colleges, and a public school system with buildings whose architecture is not approached elsewhere in the United States. The shopping facilities are unexcelled. And last, but not least, St. Louis has two baseball teams that are putting up a stiff fight for leadership in their respective leagues.

Planters Hotel, A. V. M. A. Headquarters

The Planters Hotel, at Fourth and Pine Streets, in the heart of the downtown section, will be the headquarters and place of meeting of the convention. This well-known hostlery is one of the largest and best in the city, and we are assured of good service and accommodations at reasonable rates.

Forest Park is provided with excellent arrangements for camping for automobile tourists. There are shower baths and camp stoves and excellent ground for erecting tents. Those desiring to have camping space alloted to them should address Fred W. Pape, Park Commissioner, City Hall, St. Louis, Mo.

EASTERN STATES TUBERCULOSIS CONFERENCE

The tuberculosis conference which was held in the Hall of the House of Representatives, State Capitol, Hartford, Conn., on June 6, 7 and 8, 1922, brought together veterinary practitioners and representatives of the livestock industry, as well as State and Federal employees engaged in cooperative work in the States of New York, Pennsylvania, New Jersey, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. The attendance of more than 400 persons testified to the interest which tuberculosis eradication has aroused and it was generally stated that the conference was most fruitful in making clear various problems which confront those engaged in tuberculosis eradication.

Commissioner Whittlesey and the members of the Connecticut Veterinary Medical Association, who so ably assisted him, have every reason to feel proud of the results of their laborious work in arranging and carrying on the conference so successfully.

The conference was opened on Tuesday morning by the Hon. J. M. Whittlesey, Commissioner of Domestic Animals, Hartford, Conn., who in a few well-chosen remarks introduced Dr. John R. Mohler, Chief of the Bureau of Animal Industry, Washington, D. C., as presiding officer. Dr. Mohler in his address attributed the success of the tuberculosis eradication campaign to the cooperation between livestock owners, veterinarians, and sanitary officials throughout the country. He stated that there has probably been no vital public health work which has had more hearty support than the campaign for tuberculosis eradication. The work required the confidence of the public, he said, and demanded tact and diplomacy as well as technical skill. "The fact that so much progress has attended the campaign attests to the competence of the field forces working on the problem," declared Dr. Mohler.

The Hon. Everett J. Lake, Governor of Connecticut, in his

address of welcome said: "It has been one of the great privileges of my administration to call a conference of this kind. I am proud of the privilege of backing up this State department to the extent of my ability for conserving the public health and the public weal through the elimination of bovine tuberculosis." He paid high tribute to Commissioner Whittlesey, and stated that the work of tuberculosis eradication was being conducted on sound, conservative lines.

Dr. C. S. Cheney, President of the Connecticut Veterinary Medical Association, responded to Governor Lake's address.

The object of the conference was stated by Dr. Mohler and its importance shown from the fact that the area covered contains one-twelfth of the bovine population and approximately one-fifth of the tuberculous cattle of the country. Stress was laid on the importance of sanitary measures in the prevention of reinfection.

A report of progress of tuberculosis eradication was given by representatives from each State participating in the conference.

The Hon. H. M. Tucker, Chief, Division of Animal Industry, Maine, said that of cattle tested to date 2.7 per cent reacted. Cattle owners were cooperating willingly in the work.

Dr. A. S. Pierce read the report of Dr. L. H. Howard, Director of Animal Industry of Massachusetts. This State, although late in cooperating with the Federal Bureau of Animal Industry, he stated, was now progressing rapidly in the eradication of tuberculosis.

Hon. A. S. Felker, Commissioner of Agriculture, Concord, N. H., was unable to attend. His report was presented by Dr. R. W. Smith, State veterinarian of New Hampshire.

Dr. J. H. McNeil, Chief, Bureau of Animal Industry, Trenton, N. J., reported that 28 per cent of the herds tested in his State were found tuberculous. He outlined difficulties encountered in eradication work owing to conditions peculiar to parts of New Jersey. All of the certified dairies and State institution herds were fully accredited.

The Hon. Berne A. Pyrke, Commissioner of Agriculture, Albany, N. Y., reviewed the tuberculosis situation in New York State, and preferred to designate the work being done as tuberculosis control rather than tuberculosis eradication, since the high per cent of infection present and the large expenditure of money required successfully to suppress the disease made the

total elimination of tuberculosis from the State a remote possibility. He was greatly encouraged, however, by the results of area work just completed in Essex County, New York, and felt that this demonstration would have a stimulating effect on the progress of the tuberculosis campaign.

The Hon. E. S. Brigham, Commissioner of Agriculture, Montpelier, Vermont, spoke in a brief but enthusiastic manner of the progress of tuberculosis eradication in Vermont.

The Hon. John J. Dunn, Secretary of the State Board of Agriculture, Providence, R. I., discussed the work in Rhode Island.

The afternoon session was given over to veterinarians engaged in tuberculosis eradication. The discussion brought out much valuable information on various phases of the work.

"Accredited Herd Tuberculosis Eradication Work" was discussed by Dr. T. E. Munce, Harrisburg, Pa.; Dr. L. H. Adams, Montpelier, Vt.; Dr. R. W. Smith, Concord, N. H., and Dr. P .E. Quinn, Harrisburg, Pa.

The "Difficulties in Eradicating Tuberculosis in Herds When Infection is Long Established" was discussed by Dr. H. B. Leonard, Albany, N. Y.; Dr. A. J. DeFossett, Montpelier, Vt.; Dr. W. G. Middleton, Trenton, N. J., and Dr. G. E. Corwin, Hartford, Conn.

Dr. T. S. Rich, Lansing, Mich., spoke on "Area Tuberculosis Eradication Work." The subject was discussed by Dr. Elmer Lash, Washington, D. C.; Dr. E. A. Crossman, Boston, Mass.; Dr. J. B. Reidy, Augusta, Me., and Dr. E. T. Faulder, Harrisburg, Pa. Throughout the conference it was apparent that the area plan of eradication was considered the most effective method of dealing with tuberculosis.

The afternoon session closed with a presentation of the subject of "Avian Tuberculosis," by Dr. B. A. Gallagher, Bacteriologist, Bureau of Animal Industry, Washington, D. C.

The Tuesday evening session opened with an illustrated lecture by Dr. S. Sisson, Professor of Anatomy, College of Veterinary Medicine, Ohio State University, on "The Lymphatic System of the Cow as Related to Tuberculosis." The excellent illustrations showed among other things the large numbers of small obscure lymph glands which are not exposed by the usual post-mortem examination and which might serve as the seat

of tuberculosis lesions in reactor animals passed as no-lesion cases.

Prof. H. R. Smith, Live Stock Commissioner, Chicago, Ill., gave an interesting address. He pointed out that bovine tuberculosis is on the decline as shown by statistics from slaughtering establishments over the country, while tuberculosis in hogs is increasing. Since avian tuberculosis is very extensive in some States and hogs are quite susceptible to it, this might account for the latter animals showing a higher per cent of infection than formerly, he suggested.

Dr. J. A. Kiernan, Chief, Tuberculosis Eradication Division, Washington, D. C., entered into a lively discussion of some of the statements made by previous speakers. He held that the tuberculosis campaign was one of eradication and not control; that its success was apparent, and that progress would be made as fast as the livestock interests and the public generally supported the movement. Colored maps were employed by the speaker to show the prevalence of tuberculosis in the eastern States.

The Wednesday morning session was presided over by Dr. Stephen J. Maher, President of the Connecticut Tuberculosis Commission, as this session was devoted principally to addresses by prominent physicians on the relation of bovine tuberculosis to human medicine.

Dr. G. E. Corwin, Deputy Commissioner on Domestic Animals, Hartford, Conn., presented the subject "Tuberculin Testing" and Dr. E. C. Schroeder, Washington, D. C., followed with an address on "Some Facts Relative to Bovine Tuberculosis Eradication." In the discussion which ensued Dr. Watson of Ottawa, Canada, said that too little of the specialists' side of the tuberculosis question is usually given in comparison with the practical work. He thought that States should provide funds for research work. The importance of research work in the eradication of bovine tuberculosis was emphasized by others of the speakers. Mr. Frank Walker, Chairman of the Livestock Sanitary Board of Virginia and a breeder of pure-bred cattle, participated in the discussion.

Dr. David R. Lyman, Superintendent, Gaylord Farm Sanitarium, Wallingford, Conn., spoke on the "necessity of Protection from Infection of Bovine Tuberculosis in the Control of Tuberculosis in the Human." Specialists in human tuberculo-

sis were intensely interested in such conferences as the present one, he declared, since there is no doubt that man is susceptible to bovine tuberculosis. Investigators have reported that over 50 per cent of cases of tuberculosis in children under five years old are due to bovine infection, he said. In concluding he remarked: "It is far better that we sacrifice a great many cattle than that we risk the life of one child in this State."

Dr. Edward B. Hooker, President of the Hartford Tuberculosis Society, gave an interesting address on the "Prevention of Tuberculosis." He attributed much of the disease to lack of resistance on the part of the child as a result of undernourishment. "A large percentage of tuberculosis in adults is simply a development of tuberculosis acquired in childhood," he declared.

"We are expending this year in Connecticut approximately $200,000 for the reduction of tuberculosis in cattle, and we are convinced that this work has resulted in considerable reduction in the case of bovine tuberculosis, particularly in children," said Dr. John T. Black, Commissioner, State Department of Health, Hartford, Conn., in presenting the subject, "Tuberculosis as a Health and Economic Problem." He hoped that statistics which he gave would convince the most skeptical that no better investment of public moneys can be made than the investment for tuberculosis eradication work.

Dr. Cole B. Gibson, Superintendent of the Undercliff Sanitarium, Meriden, Conn., gave an interesting talk on "Tuberculosis Sanitarium for Children at Meriden as guests of Dr.

The afternoon was spent in a visit to the Connecticut Tuberculosis Sanitarium for Children at Meriden as guests of Dr. Gibson.

Wednesday evening was devoted to a reception, banquet and dancing at the Hotel Bond. Dr. A. T. Gilyard, Vice President, Connecticut Veterinary Medical Association, was toastmaster. The speakers were Dr. Thos. E. Maloney, Fall River, Mass.; Dr. F. Torrance, Veterinary Director General, Ottawa, Canada; Dr. John R. Mohler, Chief, Bureau of Animal Industry, Washington, D. C.; Dr. J. A. Kiernan, Chief, Division of Tuberculosis Eradication, Washington, D. C., and the Hon. Jas. M. Whittlesey, Commissioner on Domestic Animals, Hartford, Conn.

Thursday was cattle breeders' and veterinary practitioners' day at the conference.

Mr. W. S. Martin, Plainfield, Vt., spoke highly of the tuberculosis campaign, declaring it economically sound, and stated that it was not only improving the breeds of livestock but also the public health.

Mr. D. H. McLaurey, Director of the Bureau of Animal Industry, Albany, N. Y., read an address prepared by Mr. A. A. Hartshorn, Hamilton, N. Y., on "Some Fundamentals for a Successful Tuberculosis Eradication Campaign." He said little progress in eradication had been achieved until the system of accrediting herds was instituted.

Mr. Joseph Alsop, Chairman, Connecticut Dairymen's Association, Avon, Conn., stated that he is firmly convinced that the work of tuberculosis eradication can advance only along lines of the general public demand. For this reason he believes, he said, that the condition in Connecticut is an exceedingly healthy one because the demands of the farmers for better control of bovine tuberculosis is greater than the State can at present fulfill.

Several other breeders gave impromptu talks in which the work of tuberculosis eradication was highly commended. One breeder told of his experience that in eliminating tuberculosis from the herd all his shy breeders had also been removed.

"How the Practitioner is Cooperating in the Movement to Eradicate Bovine Tuberculosis" was ably told by Dr. Thos. E. Maloney of Fall River, Mass. He stated that a means should be found to employ to a greater extent the services of practitioners in the work of tuberculosis eradication. A lively discussion followed, which brought out the various advantages and difficulties which beset the problem. Lack of sufficient appropriations and high cost of indemnities, it was pointed out, limited the amounts of testing which could be undertaken. Herds under supervision were being turned over to the practitioners as rapidly as possible, it was stated, and in some States the testing was several months behind the schedule owing to the inability of local practitioners to keep up with the demands being made upon them.

Among those who discussed the subject were Dr. Thos. Bland, Waterbury, Conn.; Dr. H. M. Lewis, Nashua, N. H.; Dr. E. H. Bancroft, Barre, Vt.; Dr. P. T. Keeley, Waterbury, Conn.; Dr. DeVine, Dr. Colton, Dr. Crossman, Dr. DeFossett, Mr. Cook, Secretary of the Jersey Cattle Association of Connecti-

cut; Mr. Walker, Chairman of the Live Stock Sanitary Board of Virginia; Commissioner Whittlesey of Connecticut, and Mr. Holt, Dairy and Food Commissioner of Connecticut.

Invitations for the 1923 conference were extended by Dr. Torrance for Canada and Dr. Smith for New Hampshire.

The session closed with the adoption of resolutions prepared by the advisory committee appointed by the presiding officer, Dr. Mohler. The members of the committee were Mr. Brigham, Chairman; Dr. Torrance, Mr. Whittlesey, Dr. McNeil and Dr. Crossman. The resolutions expressed appreciation for the interest which the Governor of Connecticut took in the conference, endorsed the work of tuberculosis eradication, and recommended that the proceedings of the conference be printed.

Thursday afternoon many members of the conference motored to the Model Dairy Farm upon invitation of Mr. Joseph Alsop, Avon, Conn.

A well-filled program for the entertainment of the ladies was carried out by Dr. Chas. L. Colton and his busy aids.

B. A. GALLAGHER, *Recorder.*

IDAHO VETERINARY MEDICAL ASSOCIATION

The second annual meeting of the Idaho Veterinary Medical Association, as scheduled, was held in the Chamber of Commerce rooms in Boise on May 11. All of the officers were present and also, with few exceptions, all of the standing committees, with a total attendance of forty-five veterinarians. The association now has a membership of fifty-two; fifteen new members were secured at this session.

The forenoon session, as indicated by the program and as presented, was of a broad, fraternal, educational nature, and was much appreciated by all.

Dr. Enoch A. Bryan, Idaho Commissioner of Education, formerly President of Washington State College, gave a splendid address on the rise and development of veterinary science, its present high standard and its extreme importance as a great humanitarian measure in its relation to public health and its economical value. Doctor Bryan also recognized the great progress in the status of the profession at this time in this State, and the splendid organization now existing.

Dr. F. W. Almond, M. D., State Medical Advisor, read a paper

on some points in the cooperation of the medical and veterinary professions in relation to public health. He emphasized the importance of the cooperation that should exist between the professions in relation to public health, discussing briefly some of the animal diseases transmissible to man, epecially bovine tuberculosis.

Dr. L. P. McCalla, M. D., President of the "League for the Conservation of Public Health," expressed his appreciation of the opportunity to talk to our organization, outlining the purposes of the League and its work, which is wholly educational and seeks only to present information vitally necessary to the people in preventing diseases and conserving public health.

Dr. B. F. Taylor, Professor of Veterinary Science at the University of Idaho, read a paper on "The Relation of the Veterinary Department of the University of Idaho to the Animal Husbandry Students."

Dr. E. E. Wegner, Dean of the College of Veterinary Science of the Washington State College, gave a very interesting, instructive and encouraging impromptu address on veterinary science, its progress and development, and the high standard of its attainment, touching on the period of depression just gone through, with an optimistic view of the future. He also spoke of the diversity of the modern practice, taking in all classes of animals, and that veterinarians should give every attention and appreciate the new field of opportunity in poultry practice. His speech developed into a real "heart to heart" talk which was thoroughly appreciated and enjoyed by all.

The afternoon and evening sessions were devoted to the business of the association and the reading of papers, and discussion of subjects of a technical and scientific nature.

Papers on the following subjects were presented, and interesting and instructive discussion developed among the veterinarians present:

"Traumatic Pericarditis in the Cow," by Dr. S. E. Nelson.

"Canine Distemper," by Dr. W. R. Smith.

"Bovine Sterility and its Treatment," by Drs. Groom and McCoy of Twin Falls.

"Pitfalls of the Veterinarian," by Dr. J. H. Plank.

"Mastitis in the Cow," by Dr. F. H. Hostetler.

A full report of the proceedings of this meeting will be published and mailed to all members of the association.

Dr. W. A. Sullivan talked on "State and Federal Cooperation in Animal Disease Control and its Relation to the Practitioner," which was enthusiastically discussed by all.

Dr. A. G. Moore, of Ontario, Oreg., gave an account of a local occurrence of anthrax, which developed an interesting discussion, particularly from B. A. I. veterinarians, as an outbreak of this disease has never occurred in Idaho.

Dr. J. D. Adams, Resident Secretary for the A. V. M. A., made another earnest appeal to the veterinarians on the extreme importance of joining the American Association.

The President, Dr. R. B. Hurd, made a brief talk on the success of the convention, and commended the membership on the splendid attendance.

As there was no election of officers to be held at this session, after the report of the secretary and treasurer, and reports of committees were accepted and resolutions adopted, the meeting adjourned sine die.

J. D. ADAMS, *Secretary.*

COLORADO VETERINARY MEDICAL ASSOCIATION

The semi-annual meeting of the Colorado Veterinary Medical Association, consisting of a three-day session, was held at the Colorado Agricultural College at Fort Collins on June 1, 2 and 3. In the business session, the chief item for discussion was legislation, since the Colorado legislature will be in session before the next meeting of the association. The legislative committee was directed to prepare a bill, regulating the sale of tuberculin within the State. It was also directed to prepare a measure limiting to licensed veterinarians the sale of biological preparations capable of spreading disease.

On the question of the reorganization of the American Veterinary Medical Association and the unification of all veterinary organizations, a committee presented the following resolution, which was adopted.

Whereas there is apparent necessity for a larger organization of the veterinary profession, and

Whereas we believe the affairs of the American Veterinary Medical Association can be more equitably managed by initiating and giving representation to State and District associations, and

Whereas we believe this representation of these associations

will create a more democratic organization, capable through a greater interest by the practitioner, of accomplishing much for the profession through united action, and

Whereas all businesses and professions are progressing only in direct ratio to their efficient organization, and

Whereas there has already developed manifest interest in the necessity of reorganization through various associations, and represented at present by a special committee of the American Veterinary Medical Association.

NOW THEREFORE BE IT RESOLVED that the Colorado Veterinary Medical Association in convention assembled do hereby approve of the reorganization program as outlined by this committee to its fullest possibilities and lend our united support to its accomplishments at the next meeting of the A. V. M. A.

A. N. CARROLL and
R. F. BOURNE, *Committee.*

The antivivisectionists having prepared a bill to be initiated at the fall election, which would prohibit all experiments on animals, the following resolution on this subject was adopted:

Whereas an antivivisection bill has been presented to the people of Colorado, and

Whereas this bill would effectually stop all animal experimentation, and

Whereas we believe that it would prevent further research into either animal or human disease, and

Whereas we believe this bill, if it should become a law, would be very inimical to the livestock industry;

THEREFORE BE IT RESOLVED that we use our best efforts to defeat the bill and urge each one of our members to do likewise.

Under the title of "Antivivisection and Modern Medicine," Dr. G. W. Stiles, Bureau Pathologist at Denver, discussed the value that animal experimentation had been in the development of medicine. He pointed out that without animal experimentation, medicine would lapse into the dark ages.

Two instances of actinobacillosis, one a considerable outbreak, were discovered by Dr. E. E. Tobin. The diagnosis had been made at the Agricultural College. The inference was that this disease may be more common than we suspect.

The question of "Tuberculosis in Colorado" was discussed by Dr. B. F. Davis, State Veterinarian of Wyoming, and Dr. C. G. Lamb, State Veterinarian of Colorado. The immediate cause of this discussion was a recent quarantine promulgated by the Governor of Wyoming, which effectually prohibits the importation of dairy cattle from Colorado. It was pointed out

by Dr. Davis, in support of this quarantine regulation, that Colorado laws did not provide for the disposition of reacting animals and that in certain cases these tuberculous animals had found their way into Wyoming, thereby tending to spread the disease. He stated that whenever Colorado saw fit to pass a law which would effectually dispose of reactors, the State of Wyoming would be pleased to abate the quarantine. Dr. Lamb admitted the unfortunate conditions, but stated that under the existing statutes he was powerless to do otherwise at this time. The consensus of opinion seemed to be that while the Wyoming quarantine was somewhat drastic, yet Colorado had been negligent in properly handling its tuberculous animals, and that until such time as our laws could be amended on this subject we might expect such action as was taken by the State of Wyoming.

The subject of poultry diseases was efficiently handled by Dr. F. R. Beaudette, Poultry Pathologist of the Kansas Agricultural College. He not only covered the subject from a theoretical point of view, but also discussed a large number of clinical cases which were presented.

Dr. A. T. Kinsley, President of the A. V. M. A., discussed swine diseases, both from the theoretical and clinical standpoint.

Dr. R. F. Bourne presented a small pig, which had previously been fed eggs of *Ascaris lumbricoides*. The pig showed typical signs of thumps while alive, and the presence of pneumonia with many hemorrhages, following death. The larvae of the ascarid were demonstrated in the bronchial mucus. Dr. Bourne also showed the moving picture illustrating the life history of the ascarid of swine, which had been loaned by the U. S. Department of Agriculture for this purpose.

A considerable number of animals showing various genital diseases was exhibited and discussed by Dr. H. E. Kingman. A number of pathological specimens gathered at the packing houses in Denver were also discussed in connection with this phase of the clinic.

The annual banquet and ball, which are usual features of this meeting, were held at the new Women's Building at the Colorado Agricultural College on the evening of June 2.

I. E. NEWSOM, *Secretary.*

ARKANSAS VETERINARY ASSOCIATION

The semi-annual meeting of the Arkansas Veterinary Association was held at the Marion Hotel, Little Rock, on June 9. Those in attendance state that it was the most interesting and harmonious meeting that has been conducted in several years.

The address of welcome was given by Honorable Ben D. Brickhouse, Mayor of the City of Little Rock, who stated in part that the veterinary profession has a service to perform and that he had always favored the employment of veterinarians in municipal health work. The veterinarians were diplomatically criticized for their indifference, citing his own experience in that during his three years of office not a single veterinarian or veterinary association had suggested in any manner the importance or desirability of having a veterinarian engaged in conducting certain lines of municipal health work. He urged the importance of organization, stressed the importance of publicity through the various daily papers and agricultural publications by members of the profession furnishing articles or material. Mayor Brickhouse made many other timely and constructive suggestions, which space prevents mentioning.

Dr. W. A. McDonald, Inspector in Charge of Tick Eradication, in a few well-chosen remarks responded to the address of welcome.

Dr. D. F. Luckey, Livestock Commissioner, National Stock Yards, Illinois, delivered a stereopticon lecture on tuberculosis, which was very helpful and highly appreciated by all.

Dr. W. F. Miller, Stuttgart, being unable to attend, forwarded an excellent paper on "Municipal Testing Dairying Herds." He made a most emphatic statement that the control and eradication of tuberculosis are a social problem worthy of our most serious consideration. He adduced figures, showing that 3,000 human beings die annually from tuberculosis and that 25,000 people are totally or partially incapacitated by this disease in Arkansas, 10 per cent of the patients in one sanitarium at Denver being from Arkansas.

Dr. Earl Kittrell, Augusta, presented in a very able manner a paper entitled "Practice in the Field." He urged all the various forces engaged in encouraging poultry and stock raising to cooperate in promoting a common interest.

Dr. N. J. Hayes, Helena, read a very highly interesting paper

on "Rabies." He brought out some very fine points in differential diagnosis of this condition.

Dr. C. D. Stubbs, Assistant State Veterinarian, Little Rock, in a few well-chosen remarks gave his experience of some years' duration in the observance of the occurrence, dissemination and prevention of anthrax. This disease is highly feared in the infested districts, and he suggested that it is almost as important to treat the stock owners, in order to allay their fear, as it is the animals.

Dr. H. W. Wilson, Helena, has found that since the Arkansas razor-back has been replaced by the purebred animal, swine practice is adding considerable revenue to his yearly income. His paper discussed the "Caesarian Section of the Sow." The difficulty is in administering anesthesia in these cases without intelligent assistance; however, he has found that in emergencies this may be entrusted to some cool-headed farmer, with a minimum risk.

Dr. N. J. Pearce, Monticello, requested information regarding losses of horses and mules, which appeared to be due to buffalo gnats. It was disclosed that losses had been experienced from gnats this season in some eight or ten counties of Arkansas, being confined to the lowlands, losses probably being due to the injection of a toxin which deranged heart action, produced flatulence, which if not relieved results in ruptured stomach. No one reported losses of animals due to excessive inhalation of the gnats into the respiratory tract.

President Hubert Shull read some extracts of cures recommended in an English book published in 1678. Among other ludicrous treatments recommended, the following is an example for mad dog bite: "Take Hob-goblin, Periwincle and Box leafes, each a handful, first mince them small, then stamp them very small in a Stone Mortor and with milk or beer administer it both at the change and full of the moon."

Dr. H. W. Wilson, Helena, was elected President; Earl Kittrell, Augusta, Vice President; Joe H. Bux, Little Rock, Secretary-Treasurer.

The next meeting will be held at Little Rock some time between October 9 and 15.

JOE H. BUX, *Secretary.*

COMMUNICATIONS

ST. JOSEPH VETERINARY COLLEGE COMMENCEMENT

To the Editor:—

I am enclosing you the program of our annual commencement, and would like to say that we had a very pleasant ending of the year. We served a banquet at the St. Francis Hotel on the night of the 16th to one hundred and fourteen. A number of good speeches by prominent men was greatly enjoyed and all retired feeling they had enjoyed a splendid social evening.

The commencement exercises were conducted in the college auditorium the evening of May 17. The attendance was good. Among other guests was Dr. A. T. Kinsley, President of the American Veterinary Medical Association. The chief features of the evening were a splendid address by Dr. John S. Koen of Bloomington, Ill., and some splendid singing by that standby in veterinary meetings, Dr. J. I. Gibson.

While our class was not as large this year as was desirable, the quality of students was good, and we feel that we did splendid work throughout the year. Nearly all of the graduates took the Missouri State Board Examination, and a member of the Board told me the evening following that all had passed.

Prospects for another year are quite encouraging; many inquiries are coming from various sources, and if times ease up so that prospective students can procure the necessary funds to defray expenses, I look for a much larger attendance than we have had in the past few years.

R. C. Moore, *Former Dean.*

WISCONSIN BREEDERS APPROVE A. V. M. A. POLICY REGARDING FAKE REMEDIES

To the Editor:

Your support of our appeal for the discontinuance of traffic in false livestock remedies is appreciated. We are glad indeed to be able to anticipate the active support of the American Veterinary Medical Association in this movement. It is one in which stockmen have reason to be interested and veterinarians to be deeply concerned. The active support of such publications as the Journal of the American Veterinary

MEDICAL ASSOCIATION, the *North American Veterinarian, The Breeders' Gazette, Hoard's Dairyman, Prairie Farmer, Chicago Daily Drovers' Journal, Wisconsin Agriculturist,* and *Wisconsin Farmer,* will help much in discouraging practitioners and other distributors in dealing in such so-called remedies.

The livestock industry in this and other States can continue to be a great source of prosperity if those charged with leadership appreciate their responsibility and conduct themselves accordingly.

Thanking you again for your support and encouragement, we are, Yours very truly,

E. H. PARKER,

President, Wisconsin Live Stock Breeders' Association.

NECROLOGY

Dr. Melville Thompson Seay, Assistant State Veterinarian at Clemson College, S. C., died in Columbia, S. C., from the effects of a wound received while in swimming in a lake near that city several days ago, tetanus having set in .

Dr. Seay was a graduate of the Washington, D. C., public schools, and was a lieutenant in the A. E .F. of the World War. He was a member of the American Legion and was born in Knoxville, Tenn.

DEATH CAMAS POISONOUS TO CATTLE

Death camas, of which there are four principal species in the range country of the West, although causing heaviest losses among sheep, are also poisonous to horses and cattle. Under range conditions cattle are seldom poisoned. Horses are frequently made sick, but deaths are rare. A few cases are known where persons have been fatally poisoned by the weed. Children have eaten the bulbs out of curiosity and adults have gathered the plant, mistaking it for the edible sego. No remedy has been found for poisoning by death camas.

American Swineherd says, "The Agricultural Department in digging after facts and truths, in making discoveries to advance the farmer's interest, with their endorsement guaranteeing the great superiority of purebred hogs over scrubs, is worth millions to the farmers of the U. S., if they use this knowledge for their benefit."

THE CITY THAT ONCE WAS A TRADING POST

By FRANCIS E. TURIN

St. Louis Convention, Publicity and Tourist Bureau

OVER a century and a half ago, Pierre Laclede Liguest, a Frenchman, to whom the Spanish Government had given a monopoly of the trade with the Indians, and his stepson, Auguste Chouteau, established their trading post and called it St. Louis. This was in 1764. The trading post soon grew into a village—the outpost of civilization.

The little village grew rapidly and soon was incorporated as a city, and now it is one of the leading cities of the United States and the metropolis of a great valley.

But little did Laclede and Chouteau think as they were working their way up earth's noble river, towing by manpower the boats that contained the supplies with which they started the construction of what is today one of the greatest American cities, that their St. Louis would one day be—

One of the greatest banking centers of the world;
The largest piston-ring city in the world;
The largest sugar-mill machinery manufacturing city in the world;
The largest fur market in the world;
The largest steel furnace manufacturing city in the world;
The largest horse and mule market in the world;
The largest hide and wool market in the world;
The largest shoe-distributing market in the United States;
The largest fabric-measuring machine manufacturers in the world;
The largest brick and clay products manufacturing center in the world;
The largest center for manufactured poultry and livestock feed;
The largest hardwood and pine market in the world;
The largest coffee market in the world;
The largest hardwood lumber market in the United States;
The largest millinery center in the United States;
The largest manufactory in the country of cotton and duck garments and uniforms;

The largest grain center in the United States;
The largest railway and street-car manufacturing center in the United States;
The largest bag manufacturing center in the United States;

And contain—

The largest house in the world for butchers' supplies and packing-house machinery;
The largest terra cotta works in the world;
The largest drug house in the world;
The largest lead works in the world;
The largest hardware house and market in the world;
The largest rug house in the world;
The largest wholesale paper house;
The largest buggy factory;
The largest tobacco factory;
The largest bird cage ever built;
The largest and longest double-deck steel span bridge in the world;
The largest plant in the United States for building crushers and pulverizers;
The largest freight transfer company in the United States;
The largest blowpipe factory in the United States;
The largest woodenware house in the world; and many other "largest in the world."

It has long been said that Missouri could build a fence along her borders and support her natives without calling on the outside for assistance. Without a doubt particular care would be taken to see to it that the fence included the metropolis of the State on the eastern border—St. Louis.

Laclede and Chouteau carried their banks on their backs, or in their canoes, and trade was maintained with the Indians through gaudy trinkets, beads and whatnots, as well as with the necessities of life and luxuries

which had been brought from the eastern civilization. What a comparison with our modern business methods and banks.

The Government recognized the importance of the St. Louis district and not so long ago awarded a Federal Reserve and Federal Land Bank to the city. Through this award St. Louis became the only city in the United States with such Federal bank strength.

The strategic position occupied by St. Louis is better realized by the knowledge that it is just about midway between the center of population, a short distance east of St. Louis, and the geographical center of the United States, a short distance west of St. Louis. It is located on the Mississippi River, in the center of the Mississippi Valley, and is a railroad center of first importance, with 25 steam railroads and four electric lines, of which the Illinois Traction System is the largest, this latter also being the most important electric system in the United States.

By reason of its proximity to the geographical center of the United States, it necessarily follows that St. Louis can be more easily and more quickly reached from all parts of the United States than any other city, without a single exception.

St. Louis is modern in office buildings, hotels, beautiful parks, and has many of the first homes in the country, and at the same time is older than the United States and rich in romantic traditions.

The city spreads over 62½ square miles of territory and is within a night's ride of over 50,000,000 people.

Over 37 per cent of the city's inhabitants are home owners, and the residential districts of St. Louis are among the most beautiful in the United States.

The four bridges which span the Mississippi River at St. Louis, including the Municipal Free Bridge, which is the largest double-deck steel-span bridge in the world, are valuable assets and sights visitors should see. The Free Bridge and approach are two miles long.

Forest Park Highlands, "The Big Place on the Hill," is the Coney Island of St. Louis. The carnival spirit is always in existence at the Highlands and it is worth a visit for a night of fun.

St. Louis learned its lesson through the war. Close cooperation in war work taught the merchant, banker, manufacturer and business man that working together produces the right results, and St. Louis is always ready to turn out to make the visitor feel at home. The city has rightfully earned the reputation of being "the most hospitable city in the world," and the people of St. Louis work together to preserve the reputation.

Twenty-five railroads run through St. Louis to "every-

where," and the Mississippi offers opportunities for waterway transportation to Mississippi Valley points and gulf ports. The unusual combination of rail and water facilities without doubt make St. Louis the great central gateway to the Mississippi Valley, Middle West territory and the South and Southwest. The shipping facilities of the city extend in all directions with a clear sweep to the marts of the world and plainly indicate the supreme position held by St. Louis in the business of the nation.

The 124 grade schools, six public high schools, teacher's college and the junior high school offer additional pleasure to those who enjoy inspecting buildings of this character.

If you are a lover of the great outdoors you will be interested in the parks, of which there are over 2,700 acres. Forest Park, with its rolling woodlands, fast developing zoo; with the world's largest bird cage, municipal golf links and tennis courts that are artificially lighted, making them available for use at night as well as day, gridirons, baseball diamonds, soccer fields and the boats and canoes on the lagoons afford maximum opportunity for the enjoyment of outdoor sports. In this park you will find the Art Museum, which is the third finest in the country, as well as the Jefferson Memorial with its statue of Thomas Jefferson by Bitter. On Art Hill you will find the heroic statue of Saint Louis, by Niehaus, where at the base was enacted one of the most historic ceremonies in modern times when the French Legion, on its visit here, dipped its colors for the second time in history and honored St. Louis as no other city in the world has been honored.

If you are a golf player, the municipal eighteen-hole golf course at Forest Park is the best all-the-year-round golf course in the United States. There is also a nine-hole course, and a midnight sprinkling system is used so that the greens are not

wet for the early morning golfers. The course covers more than a mile from the east to the west and takes in the highest and lowest points in Forest Park. In addition to the municipal golf links there are many courses at various clubs. And if you journey out to Forest Park you should view the only municipal open-air theater in the world, where operas are shown to the delight of visitors to St. Louis and its citizens. The theater seats 10,000 people and is built entirely of concrete. The great stage is set in the natural woodlands of the park. Volumes have been written in paying tribute to St. Louis for its work along this line and you will do well to visualize the scene of activities.

Incidentally, while in St. Louis, if you have the time, pay a visit to the Old Court House, the oldest of St. Louis' public buildings, work on the building having been started in 1839 and completed in 1862 at a cost of about $1,000,000. The building is considered by experts to be a splendid example of historical structure with fine architectural qualities and is located at Chestnut and Market streets, between Fourth street and Broadway, and is in the form of a Greek cross and of Doric order of architecture. The building was made historic by the slave sales which took place on its steps during the Civil War, and also the whipping post was located on this site during the early days of St. Louis. The magnificent frescoes in the dome were done by Carl Wimer, in 1862, a St. Louis artist of note, and they were restored by Edmund H. Wuerpul during the World's Fair in St. Louis in 1904 and are again being restored at this time of writing.

The Missouri Botanical Garden (Shaw's Garden) is the second largest garden in the world; it is the largest in America. Only the Royal Gardens at Kew, England, excel it. The garden covers approximately 125 acres of ground, and collections from plant life of the world are cultivated by experts at one of Nature's beauty spots. The garden is one of the show places of St. Louis and visitors are always welcome.

The city that once was a trading post has gradually grown great in many things. Today St. Louis is a buying and fashion center, a leader among the world marts, in addition to claiming greatness in industrial development. The city actually rivals Paris in styles in various ready-to-wear lines.

St. Louis is a "home" city and its people are God-loving and God-fearing. The houses of worship here are distributed throughout the entire city and run the gamut from old and quaint to new, modern and splendid. The old Cathedral (Catholic) on Walnut street, between Second and Third streets, with its French inscriptions, is one of the historic structures of the city.

The New Cathedral (Catholic) on Lindell Boulevard, is not only the largest church building in the United States, but is also one of the finest. "Kingshighway," from one royal fort to another during the Spanish regime, and today one of the city's finest boulevards, is the show street of the churches of St. Louis. The Second Baptist, with its great campanile, is Italian Gothic; St. John's Methodist is neither pure Greek nor pure Roman, but belongs to the Italian Renaissance of the Fifteenth century; Temple Israel (Hebrew), with its great columns, is pure Corinthian, and the Christian Science is Italian Renaissance. At Thirteenth and Locust streets is the historic Christ Church Cathedral (Episcopal), containing masterpieces of stone carving. In this church are to be found the articles of association of the first Protestant Church west of the Mississippi River.

In conclusion, please remember that "the next best thing to living in St. Louis is to be a frequent visitor." So says our Mayor.

The 772,897 people of St. Louis, or the 1,250,000 people of this district, are glad that you selected St. Louis for your convention. Come often; come early and stay late.

AID FOR RUSSIAN VETERINARIANS

At an assembly of the Veterinary Surgeon's Section, held in Simbirsk, Russia, recently, the assembled veterinarians expressed their thanks to the American people for its gifts of corn, through the medium of Edward Fox, of Pottsville, Pa., Supervisor for the American Relief Administration in Simbirsk. During the meeting Mr. Fox and his assistants, Mr. Blonquist and Mr. Godfrey, were addressed by the president, Dr. Tourgevitch.

During his talk he mentioned the numerous benefits received by the starving Russian people of America, and expressed the thanks of all Russia for the help that had been extended to

them during the martyrdom of their nation. A translation of Dr. Tourgevitch's speech is printed below:

"I am welcoming you in the name of the whole association of veterinary surgeons of Simbirsk district, and am expressing our greatest thanks for the honor you are doing us in taking part in our assembly.

"It is a great pity that such an eminent day for us coincides with the difficult time we are passing through; but I am sure, dear guests, that your participation, and the good and generous heart of the American people coming to the help of the Russian martyrs, will give us new courage, energy, and force to vanquish the misfortunes that have fallen upon us.

"If the merits of the American people in regard to our country are great, so yours, dear friends, are immense. You are far from your country, separated from your relatives, and acquaintances dear to your hearts, and are passing through many difficulties in a starving country only to bring all possible help to the suffering Russian people.

"Such merits of the American people, and yours, dear guests, cannot be forgotten. They will remain forever in the hearts of the Russian martyrs and their descendants, and will be written in golden letters on the pages of Russian history."

DUTCH GUIANA QUARANTINES AGAINST BRAZILIAN CATTLE

A shipment of 55 cattle and 83 pigs arrived in Dutch Guiana from Brazil on May 5, 1922. Two days later they were found to be infected with rinderpest and were ordered destroyed by the Government. So far as is known the disease has not spread to any local cattle. As a result of this experience the Government of Dutch Guiana has prohibited the further importation of livestock from Brazil.

Dr. Stanton Youngberg, Chief Veterinarian of the Bureau of Agriculture, Philippine Islands, is visiting the United States on a ten-month accumulated leave of absence. He has been renewing old friendships in Ohio and North Carolina and will spend the month of August in Minnesota. Dr. Youngberg has been in the Philippines for the past fifteen years and has not been in the States for ten years.